SOLAR ELECTRIC

KOSTAL

EN

Smart connections.

Installation and Operating Manual

PIKO Inverter

4.2 | 5.5 | 7.0 | 8.3 | 10.1

LEGAL NOTICE

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Exclusion of liability

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The illustrations and texts have been compiled with great care. However, the possibility of errors cannot be ruled out. The compilation is made without any guarantee.

General note on gender equality

The KOSTAL Solar Electric GmbH is aware of how language impacts on gender equality and always makes an effort to reflect this in documentation. Nevertheless, for the sake of readability we are unable to use non-gender-specific terms throughout and use the masculine form instead.

Software version above FW: 04.03

Contents

Thank you for choosing a solar inverter PIKO from KOSTAL Solar Electric GmbH!

We hope you enjoy consistently high energy yields with the PIKO inverter and your photovoltaic system.

If you have any technical questions, please call our service hotline: +49 (0)761 477 44 - 222

1 Notes on this manual

Read this manual carefully in its entirety. It contains important information on the installation and operation of the inverter. Pay particular attention to the instructions regarding safe usage. KOSTAL Solar Electric GmbH assumes no liability for damages arising from the non-observance of this manual.

This manual is an integral part of the product. It only applies to solar inverters PIKO from KOSTAL Solar Electric GmbH. Keep this manual and give it to the new owner should you pass it onto a new operator.

The installer as well as the user must always have access to this manual and must be familiar with its contents, particularly the safety instructions.

Target groups

This manual, especially chapters 8 (‹Installation›) and 9 (‹Commissioning and de-commissioning›), are intended for **specialist tradespersons**. Information relevant for the **operator** can be found in chapters 10 (‹Inverter operating characteristics›) and 11 (‹System monitoring›).

Information concerning your safety or that of the unit is highlighted especially.

2 Proper use

The inverter PIKO converts direct current into alternating current and supplies it to the public mains grid. The device may only be used in grid-connected photovoltaic systems within the permissible power range and under the permissible environmental conditions. The device may only be operated in PV systems in which no electrical pole is earthed. The device is not intended for mobile use.

Inappropriate use can be hazardous and lead to injury or even death of the user or third parties. Material damage to the device and other equipment can also occur. The inverter may therefore only be used for its intended purpose.

Exclusion of liability

Any use that differs from or goes beyond the stated intended purpose is considered inappropriate. The manufacturer accepts no liability for any damage resulting from this. Modifications to the inverter are prohibited. The inverter may only be used if safe to operate and in technically perfect condition. Any instance of misuse will cause the termination of the warranty, guarantee and general liability of the manufacturer.

Only a qualified electrician may open the device. The inverter must be installed by an electrician who is responsible for observing the applicable norms and regulations. Work that could affect the electrical power system of the respective utility company at the site of the solar energy feed-in may only be carried out by qualified electricians expressly authorised (licensed) by the utility company.

This includes changes to the factory pre-set parameters. The installer must always observe the regulations of the utility company. The utility company's specifications must always be observed when setting the parameters, since otherwise the ENS (grid monitoring) will no longer function correctly.

3 EU Declaration of Conformity

SOLAR ELECTRIC

KOSTAL

EU Declaration of Conformity

The company

KOSTAL Solar Electric GmbH
Hanferstraße 6
79108 Freiburg i. Br., Deutschland

hereby declares that the inverters

**PIKO 4.2 (DCS), PIKO 5.5 (DCS), PIKO 7.0 (DCS, AD),
PIKO 8.3 (DCS, AD), PIKO 10.1 (DCS, AD)**

to which this declaration refers, conform to the following guidelines and standards.

Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility

DIRECTIVE 2006/95/EC on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits
Application of the CE mark in accordance with Annex III, Section B: 2013

EN 61000-3-2:2006/A1:2009/A2:2009 (Harmonic currents)

EN 61000-3-3:2008 (Flicker)

EN 61000-6-2:2005/AC:2005 (Interference resistance for industrial environments)

EN 61000-6-3:2007/A1:2011 (Interference emission for domestic environments)

EN 62109-1: 2010 (Safety of converters for use in photovoltaic energy systems) - Part 1

EN 62109-2: 2011 (Safety of converters for use in photovoltaic energy systems) - Part 2

This declaration applies to all identical copies of this product. This declaration loses its validity if the device is modified or incorrectly connected.

KOSTAL Solar Electric GmbH – 2013-05-03

Werner Palm
(managing director)

Dr. Armin von Preetzmann
(Bereichsleiter Entwicklung)

This declaration certifies the compliance with the mentioned regulations but does not ensure the properties. The safety instructions in the product documentation provided must be observed!

Fig. 1: *EU Declaration of Conformity*

4 Safety instructions

Safety instructions have been incorporated into the instruction text.

These safety instructions tell you about possible risks.

Each safety instruction consists of the following elements:

Element	Example
Warning symbol	
Signal word	Danger
Type of danger	Risk of death due to electrical shock!
Corrective actions	Always disconnect the device from the power supply during installation and before maintenance and repairs and lock it to prevent it being switched back on.

Table 1: *Structure of the safety instructions*

4.1 Warning symbols

Warning symbols identify the type of danger.

The following warning symbols are used:

	**Danger due to electrical shock**
	**Danger due to electromagnetic fields**
	**Danger due to burns**
	**Danger due to electrical discharge!** With an indication of the discharge duration of the capacitors following disconnection of the inverter
	Other dangers

Table 2: *Warning symbols*

4.2 Signal words

Signal words are used to identify the severity of the danger.

These signal words are used in this manual:

Danger: Serious injuries possibly resulting in death may occur.

Warning: Minor injuries or severe damage to property may occur.

Attention: Minor damage to property may occur.

4.3 Safety markings

The labels and markings attached to the housing by the manufacturer may not be changed or removed.

4.4 Types of danger

Before working on an inverter, the device must always be de-energised.

The inverter is only de-energised after the following work steps have been carried out.

⚠ IMPORTANT INFORMATION

These work steps must be performed before carrying out any work on the inverter!

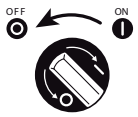
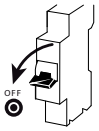
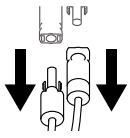
1.		Switch off DC switch
2.		Switch off line circuit breaker For internal consumption: Switch off line circuit breaker for the control of internal consumption.
3.		Secure it against reactivation.
4.		Disconnect DC lines
5.		Wait five minutes (discharge time of the capacitors)

Table 3: *De-energise the inverter*

The following dangers exist when working on the inverter:

	**Danger due to electrical shock!** Always disconnect the device from the power supply during installation and before maintenance and repairs (see Table 3).
	**Danger due to electromagnetic fields!** Persons with pacemakers, metallic implants or hearing aids should avoid proximity to systems with inverters.
	**Risk of burns from hot parts!** Some of the inverter components can reach temperatures of over 80 °C during operation. Do not touch hot components.
	**Risk of fire due to hot parts!** Be absolutely sure to observe the conditions in the "Installation" chapter (page 15) when choosing the installation location.
	**Burns from arcs!** Cables must never be removed from the device during operation as this can cause dangerous arcs. First de-energise the DC side, then remove plug-in connectors!
	**Danger due to electrical discharge!** Wait five minutes after de-energising the inverter!
	**Warning! Property damage!** Property damage to the device, lost earnings or increased telephone fees can result. The instructions refer precisely to the type of and remedy for potential property damage.

Table 4: *Warning symbols*

5 Scope of delivery

The packaging contains:

— 1 inverter (*1*)

— 1 wall mount (not for replacement devices) (*2*)

— 1 short manual (3)

— 1 safety notes (4)

— 1 CD containing operating instructions (*5*)

— 1 sealing cap (5-pin) for sealing the AC terminal (mandatory in Italy) (*6*)

— Installation accessories: 4 screws DIN 571 A2 6×45, 4 screw anchors with a diameter of 8 mm and length of 40 mm, 1 tapping screw DIN 7516 form A galvanised M4×10) (*7*)

— 2 wire jumpers for parallel connection (not possible on all devices) (*8*)

— Plug seals for the screw connection for the network cable (*9*)

— 2 insulating caps (10)

— Max. 3 counterparts for plug-in connectors (*11*) (each DC input: 1 × plug, 1 × socket)

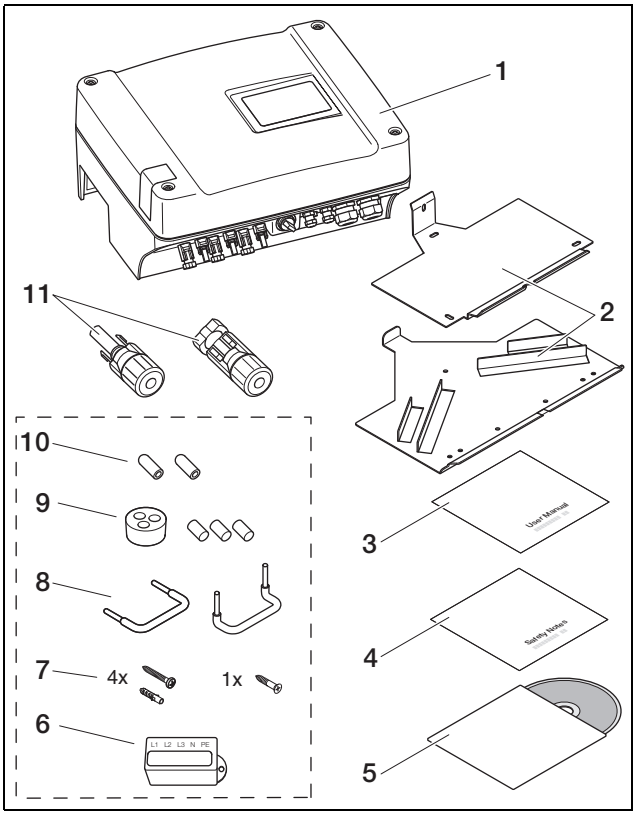


Fig. 2: *Scope of delivery*

6 Transport and storage

The function of the inverter has been tested and it has been carefully packed prior to delivery. Upon receipt, check the delivery for completeness and any transport damage. Complaints and damage claims are to be directly addressed to the shipping company.

ATTENTION

Risk of damage when the inverter is placed on its underside.

- Always place the inverter on its rear side (cooling elements) after unpacking.

If stored for a longer period before installation, all components of the inverter must be kept dry and dust-free in the original packaging.

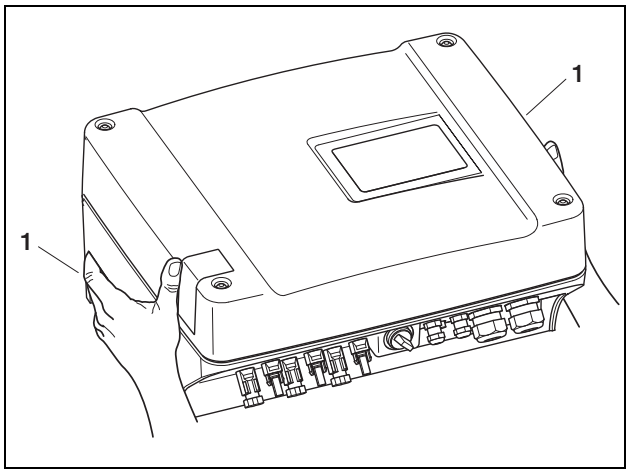


Fig. 3: *Recessed grips PIKO inverter*

Depending upon the frame size, recessed grips (1) have been integrated to the left and right for better transport of the PIKO inverter.

7 Unit and system description

Function

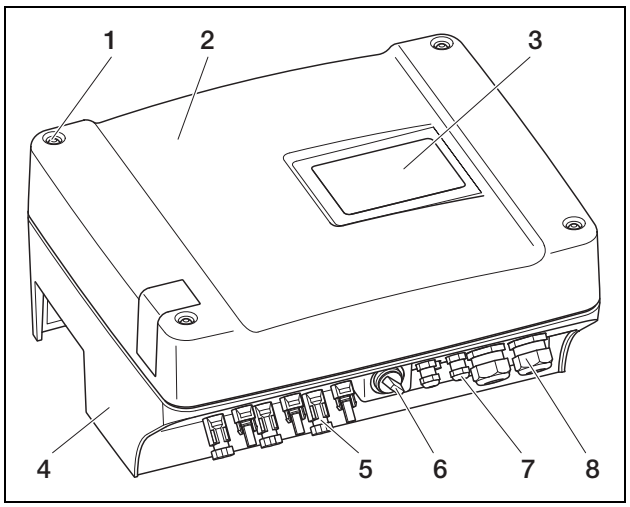


Fig. 4: *PIKO Inverter*

1 Screws
2 Cover
3 Display
4 Housing
5 Plug-in connectors for connecting the solar modules
6 DC switch
7 Cable openings for optional communication
8 Opening for the mains cable

The PIKO solar inverter is a powerful and transformer-less string inverter. It converts direct current generated by the photovoltaic modules into symmetrical, three-phase alternating current and supplies it to the public power grid. Power generation independent of the public grid (island operation) is not possible.

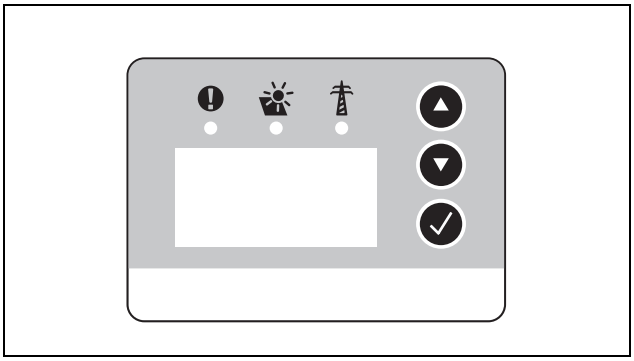


Fig. 5: *Control panel*

Through three-phase technology, PIKO 4.2/5.5/7.0/8.3/10.1 unite the stability and durability of central inverters with the flexibility and the high degree of efficiency of transformer-less string inverters.

In order to improve the degree of efficiency, PIKO 4.2/5.5/7.0/8.3/10.1 with a lower input power (less than 10 percent of the rated output) use only one or two phases for current feed-in. The device selects the phase on a random basis each time.

The PIKO inverters are fitted with an integrated DC switch. No external break switch is therefore required, unless specified by local country laws (example France). The solar modules are connected to the inverter via plug-in connectors.

The inverters PIKO are available in various output sizes (see table 22, page 50) and offer you maximum flexibility in configuring your solar energy system. This is achieved through a broad DC input voltage range, independent MPP regulators for each input, which enable the connection of solar modules in various combinations (alignment, inclination, quantity, type). In order to conveniently display the yields and production data of your photovoltaic system, the inverter has an integrated web server, see chapter 8.8.1.

Arc detection

Arcs can occur in a PV system. These arcs can cause damage. The inverters PIKO 7.0 AD/8.3 AD/10.1 AD are equipped with arc detection.

Arc types

There are two kinds of arcs:

— Serial arcs

— Parallel arcs

Serial arcs occur on damaged DC lines or at loose contact points. These arcs occur more often in PV systems than parallel arcs.

Parallel arcs can occur between the plus and minus pole of the system or at individual sub-generators. Arcs are dangerous. For one thing they destroy the components upon which they occur and high temperatures can also trigger a fire in the PV system.

The arc detection monitors the PV system for arcs. It determines the string in which an arc is occurring. The arc detection differentiates between serial or parallel arcs. In the event of a serial arc, the inverter shuts off the relevant string. This extinguishes the arc. A parallel arc is issued as an error message.

"Arc" fault

When an arc occurs, an event message referring to this appears in the display. The red LED is permanently lit, the yellow LED blinks in a 5-second rhythm and a signal tone is heard. The inverter switches off the relevant string.

After 30 seconds, the inverter attempts to switch on the relevant string again. When the inverter recognises an arc four times within a period of 30 minutes, it shuts off the defective string entirely.

The arc detection can be deactivated with the communication board II menu (default "On"). The occurring malfunctions are recorded in the inverter.

Acknowledge malfunction

The DC break switch must be switched off and on again in order to acknowledge the error message. The inverter then starts normally. When an arc occurs again, the inverter behaves as previously described.

Because it is not technically possible for an inverter to delete a parallel arc, this is only shown as a message in the display. The signal tone also sounds and the red LED lights up. The message disappears in the display once the error message is acknowledged.

Note: The entire installation of the PV system should be checked for damage after each event message referring to an arc. Inform your installer where appropriate.

Note: In rare individual cases, false alarms can occur that can be extinguished outside of the PV system. Causes for such false alarms can include, for example, transformer stations or large energy consumers.

IMPORTANT: Under certain circumstances (e. g. with feed cables >60m), arcs cannot be registered. This is why regular maintenance of the PV system is essential. Regular inspection of the installation must be carried out despite arc detection!

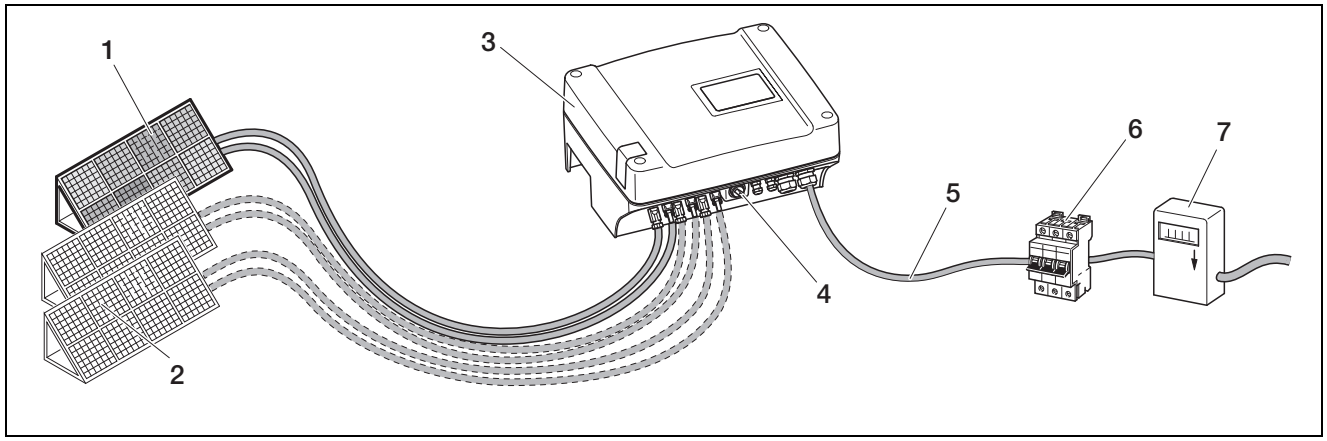


Fig. 6: *System illustration of a grid-connected photovoltaic system*

1 PV string 1
2 PV string 2 and 3 (optional)
3 Inverter
4 Electronic DC switch
5 AC mains cable
6 3-phase AC line circuit breaker (for layout, see table 6, page 18)
7 Feed meter

Inputs

The PIKO operates using the so-called string principle: In this system, a limited number of solar modules (depending on the desired power output while considering the maximum permissible input voltage) are connected in series as a string, which is then connected to the inverter. The number of strings depends upon the configuration of the solar system. The strings are connected to the inverter with plug-in connectors.

Depending on the device type, one, two or three separately controllable inputs are available. Inputs one and two can sometimes be connected in parallel in order to allow a higher input current (see table 7, page 19). For PIKO 5.5, parallel connection is not possible.

You can obtain the highest yields through the maximum permissible input voltage. This is achieved by using the smallest possible number of inputs with identical power. An example: For the installation of 48 solar modules, it is better to use two inputs with 24 modules each rather than three inputs with 16 modules each.

Be sure to always observe the specifications on the type plate!

Internal consumption

The PIKO inverters are designed in such a way that the generated current can be used internally either entirely or in part.

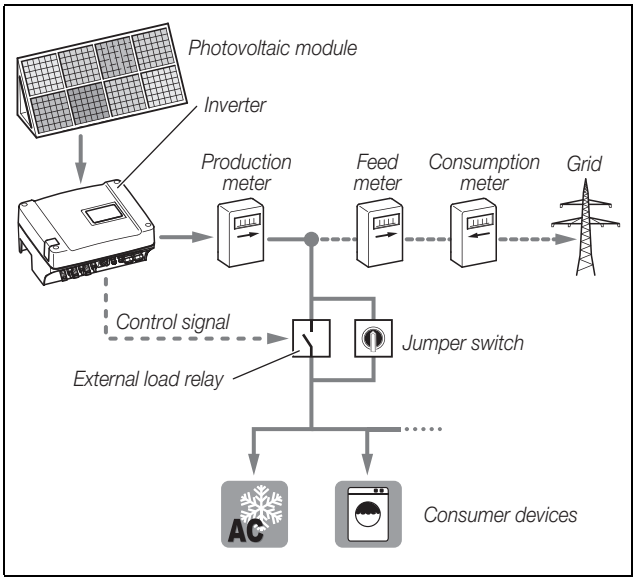


Fig. 7: *Possible configuration for internal consumption*

The switch output is a potential-free NO switch.

Note: An external load relay must be installed between inverters and devices. No devices may be connected directly to the inverter!

You can find the description for the electrical connection in section "Connect switch output (S0/AI OUT)" on page 29.

You can find the description of the S0 output configuration for the control of internal consumption in section "Setting the switch output function" on page 34.

Active power and reactive power control

The terms

There are three types of electrical power in the mains grid:

— Active power (W)
— Reactive power (Var)
— Apparent power (VA)

Active power

Active power is that electrical power that is converted by an ohmic device. Ohmic devices are devices with no coils and capacitors (e. g. heat radiators, electric stoves, light bulbs). The active power is registered by the usual electricity meters. This means that only the active power is calculated or paid for.

The active power current is "in phase". This means that current and voltage are synchronous. Both reach the zero point and the peak value at the same time.

Reactive power

Reactive power is that electrical power that is converted by inductive and capacitive devices. Inductive devices are coils. Capacitive devices are capacitors.

These devices require electrical energy in order to build up the magnetic or electrical field. This power is referred to as reactive power. Devices with motors and capacitors (e. g. washing machine) draw reactive power from the grid.

The reactive power is not registered by the usual electricity meters. However, like the active power, it does draw from the mains grid. The reactive power current is "out-of-phase". That means that current and voltage reach the zero point and the peak value at different times.

Apparent power

Apparent power is the total output, consisting of real and reactive power. The calculation of electrical power takes place through the geometrical addition with the angular functions (cosφ, sin φ and tan φ).

Displacement factor cosφ

The size of the real, reactive and apparent power can be determined with the displacement factor cosφ. The smaller the cosφ factor is, the less the active power and therefore the greater the reactive power.

Note: The displacement factor cos φ can be set with the parametrisation software PARAKO in order to define the magnitude of the reactive power.
You can acquire the software from support following registration.

VDE application rule (VDE-AR-N 4105) and Renewable Energies Act (EEG) 2012

New application rules for PV systems have applied in Germany since 1 January 2012. The VDE application rules (VDE-AR-N 4105) and the Renewable Energies Act (EEG) are compulsory. The PIKO inverters satisfy the currently required standards and guidelines.

Note: Should the PV system not fulfil the Renewable Energies Act (EEG) 2012, the grid operator can reduce the feed-in tariff or dispense with it entirely.

The following points are relevant when implementing the new application rules:

— Frequency-dependent active power control
— Active power control with a ripple control signal receiver
— Fixed limitation of the feed-in power to 70% of the PV output
— Provision of reactive power
— Regulating of unbalanced loads

Frequency-dependent active power control

To date inverters are to be immediately disconnected from the grid when they exceed the upper frequency limit of 50.2 Hz. Grid stability can be negatively impacted by the abrupt switching off of large generation plants. Hence the need for an active power reduction solution in the event of overfrequency.

This means that inverters need not be disconnected from the grid when exceeding 50.2 Hz, but instead that the active power must be reduced. This active power is then reduced by 40% per Hz. When the frequency reaches 51.5 Hz, the inverter must be immediately disconnect from the grid.

Active power control with a ripple control signal receiver

The active power of the PIKO inverter can be controlled directly by the energy supply company via a ripple control signal receiver (*1*). With this technology, the generated power can be regulated at four levels (see Fig. 8).

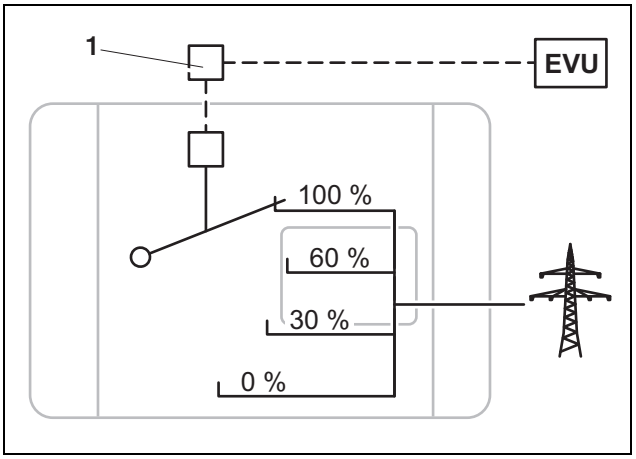


Fig. 8: Active power control with a ripple control signal receiver

Note: For all PIKO inverters, the ripple control signal receiver can be directly connected without an additional device (see section "Connecting a ripple control receiver for active power control" on page 30). The regulating function is activated in the web server of the inverter (option "Function of analogue inputs: active power control").

Fixed limitation of the feed-in power to 70% of the PV output

Should the active power control not be realisable with a ripple control signal receiver, the feed-in power is then generally to be reduced to 70% of the PV generator output according to the Renewable Energies Act 2012 (EEG 2012).

The reduction is carried out with the parametrisation software PARAKO.

Provision of reactive power

As of a system apparent power of 3.68 kVA, the energy provider must release a part of the generated power as reactive power.

With the parametrisation software PARAKO, the reactive power can be specified as follows:

cos φ	A value for cos φ is prescribed
cos φ (P)	An active power curve is prescribed

***Table 5:** Reactive power control with* PARAKO

In addition, the displacement factor cos φ can be remote-controlled through a ripple control signal receiver. Configuration to this purpose is also to be carried out with PARAKO.

8 Installation

⚠ DANGER

Risk of death due to electrical shock!

When performing any work on the inverter and feed cables:

- De-energise the AC and DC sides of the device, see chapter 9.4 ‹Disconnecting the inverter /decommissioning›.
- Secure the voltage supply from being unintentionally switched back on.
- Wait at least five minutes until the capacitors of the inverter have discharged.
- Check the device and cables to make certain that they are voltage-free.
- Prior to installation, check whether the local mains grid and the power output of the photovoltaic modules are compatible with the technical data of the inverter. Observe the type plate.
- Observe the specified sequence of installation tasks: Install the inverter first, then connect it to the electricity supply.
- Observe all national regulations in the country of use as well as the connection and safety regulations of the local energy supplier.
- Pay attention to careful and correct installation: No dirt, no foreign bodies and no moisture may enter the inverter.

8.1 Installation

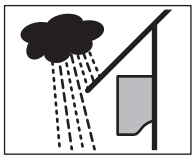
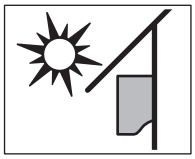
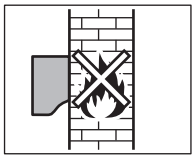
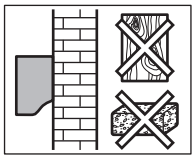
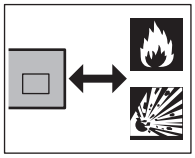
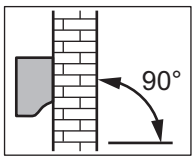
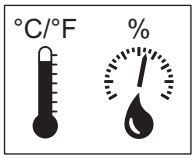
⚠ DANGER

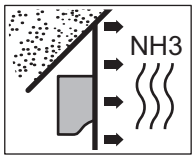
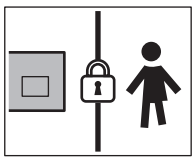
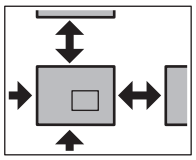
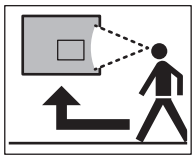
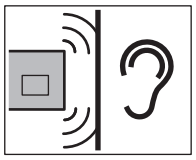
Risk of death due to improperly performed installation!

Improper installation can lead to life-threatening situations. The inverter and the components connected to it can also be damaged, increasing the risk of fire.

Selecting the installation site

Note: Observe the following instructions when selecting the installation location. Guarantee claims may be restricted or become entirely null and void in the event of failure to observe.

	Protect inverter from rain and splash water.
	Protect inverter against exposure to direct sunlight.
	Mount inverter on a non-flammable installation surface.
	Mount inverter on a stable installation surface that can securely bear the weight of the inverter. Plasterboard walls and wood planking are not permitted.
	A sufficient safety distance from flammable materials and explosion hazard areas in the vicinity are to be ensured.
	Mount inverters on vertical installation surfaces.
	The ambient temperature must lie between -20 °C and +60 °C. The air humidity must lie between 0% and 95% (non-condensing).

	Protect inverter against dust, contamination and ammonia gases. Rooms and areas containing livestock are not permitted as installation locations.
	Install inverters so that they are not accessible to children.
	Maintain a minimum distance to other inverters and other objects (see Fig. 9, page 16). Minimum distance, horizontal: 100 mm Minimum distance, vertical: 200 mm An unimpeded air supply must be assured!
	Inverter must be easily accessible and the display clearly visible.
	Inverter can cause noise when in operation. Install inverter in such a way that people are not disturbed by operation noises.

Installing the wall mount and hanging the inverter

- Mark the positions of the drill holes at the installation site by using the wall mount as a drilling template.

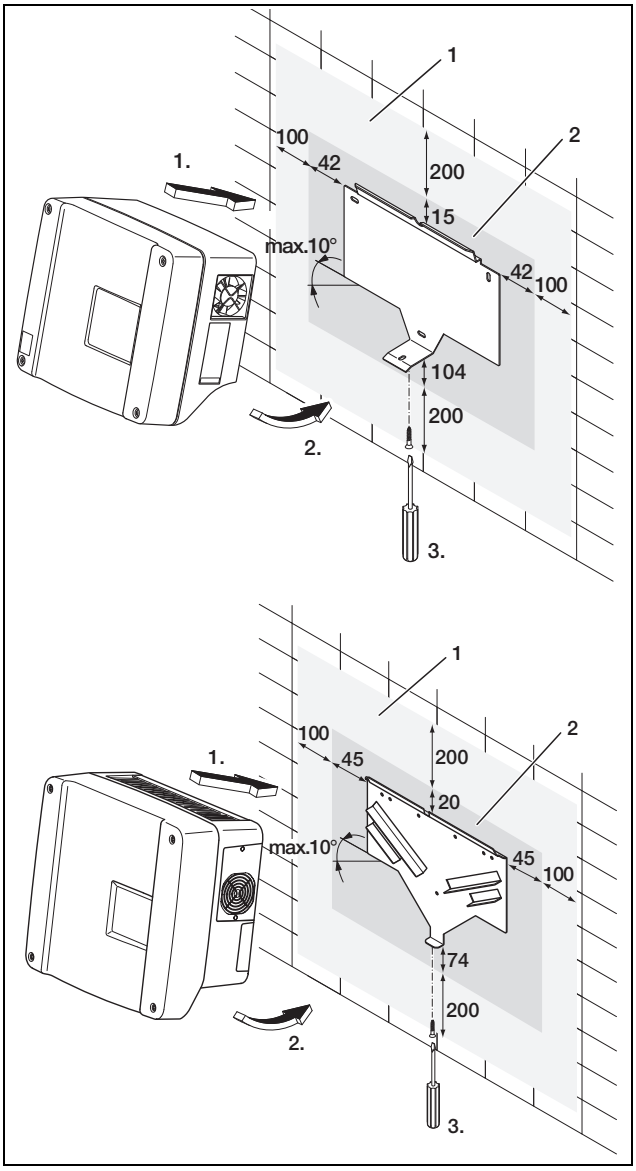


Fig. 9: *Install the inverter (top: PIKO 4.2/5.5, bottom: PIKO 7.0/8.3/10.1)*

1 Required space for cooling
2 Outer dimensions of the inverter

- Drill holes and insert wall anchors if necessary.
- Screw the wall mount to the intended surface. Use the supplied screws.
- Hang the inverter on the wall mount.
- Fasten the inverter on the underside using the supplied screw.

8.2 Electrical connection

⚠ DANGER

Risk of death due to electrical shock!

If exposed, voltage-carrying cables make contact, an electrical arc can occur, posing a life-threatening hazard.

- Only remove as much of the cable insulation as is necessary. The insulation must reach up to the terminal.

⚠ DANGER

Risk of death due to electrical shock!

Metal slivers can fall into the inverter when removing the insulation. Contact with voltage-carrying components during operation can cause an electrical arc to occur, posing a life-threatening hazard.

- Never remove the cable insulation above the inverter!

⚠ DANGER

Injuries can result from destruction of the device!

When the maximum values of the permitted input voltage at the DC inputs of the inverter are exceeded, this can result in serious damage, which can lead to the destruction of the device and to considerable injuries to persons present. Even brief exceeding of the voltage can already cause damage to the inverter.

- Prior to connection of the DC plugs to the inverter, check for the correct planning and wiring of the modules and subsequently measure the DC idling voltage. Please ensure that the maximum permitted DC idling voltage is not exceeded. Log the measurement values. In the event of a complaint, please provide these measurement values.

  Failure to do so will make any warranty, guarantee or liability of the manufacturer null and void when you can not prove that the damage was not due to non-observance.

Opening the housing

- Release the four screws of the cover and carefully remove the cover.

8.3 Connecting the AC side

- Unscrew the cable screw connection for the mains cable (*1* in figure 10).

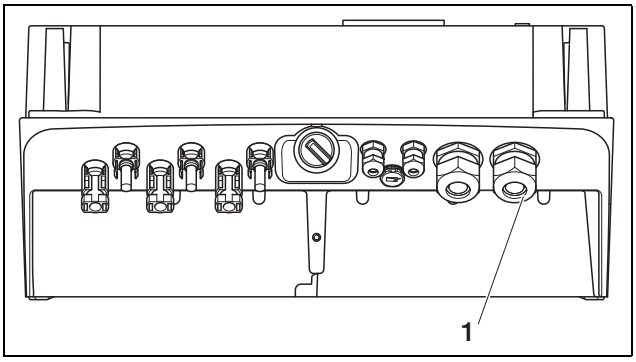


Fig. 10: *Connection on the housing (the number of usable inputs depends on the model)*

1 Cable screw connection for mains cable

- Press the blind plug and the sealing ring out of the screw connection **from the inside outwards** using a screwdriver or similar implement. Detach the sealing ring from the blind plug.

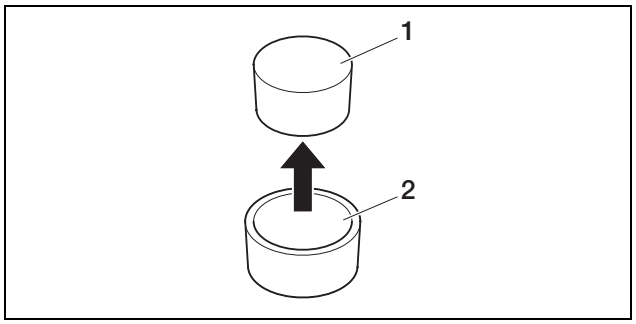


Fig. 11: *Pressing the blind plug out of the sealing ring*

1 Blind plug
2 Sealing ring

We recommend a mains cable with the cross-section 3×2.5 mm^2. The outer diameter of the cable can be 9...17 mm, the cross-section of the individual conductors can be a max. of 4 mm² for flexible cables and a max. of 6 mm² for rigid cables. For flexible cables, we recommend using core end sleeves.

- Remove the sheath and the insulation of the mains cable as much as needed.
- First thread the unscrewed union nut (*4* in illustration 12) and then the sealing ring (*3* in illustration 12) over the mains cable.
- Guide the mains cable through the cable duct into the interior of the inverter.
- Thread the sealing cap (illustration 13) over the mains cable. The sealing cap is mandatory in Italy.

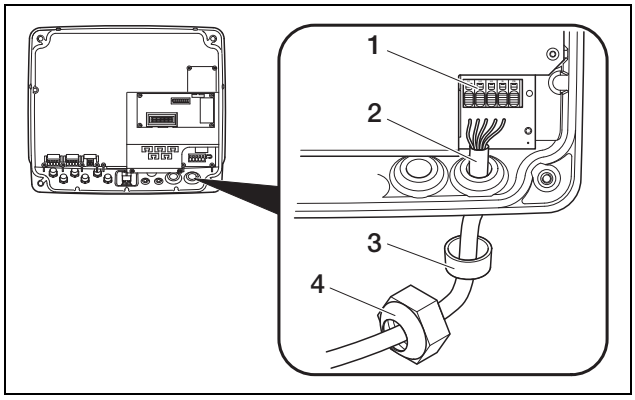


Fig. 12: *Laying the mains cable*

1 AC terminal
2 Mains cable
3 Sealing ring
4 Union nut

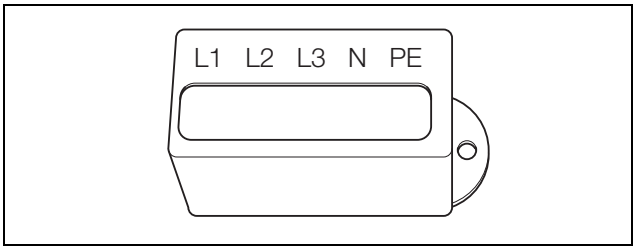


Fig. 13: *Sealing cap for AC terminal*

Note: To connect the AC and DC cables, the inverter is equipped with spring-loaded terminal strips (figure 14).

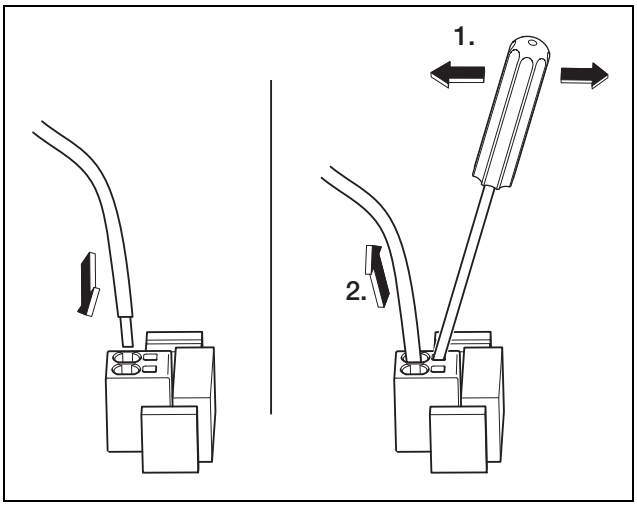


Fig. 14: *Spring-loaded terminal strip: Fastening the cable (left), detaching the cable (right)*

- Connect the wires of the mains cable to the AC terminal in accordance with the labelling (figure 15).

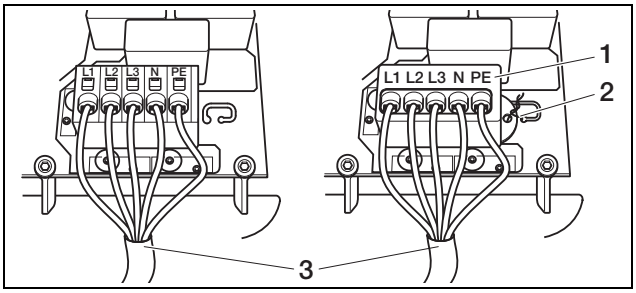


Fig. 15: *Mains cable connected (left without sealing cap, right with sealing cap (shown PIKO 7.0/8.3/10.1)*

1 Sealing cap
2 Sealing wire
3 Mains cable

- Place the sealing cap on the terminal block and attach the seal. The sealing cap is mandatory in Italy.
- Screw the union nut with inner sealing ring and plug tightly onto the cable screw connection.

Note: The threaded cable connection seals the housing against moisture and functions as strain relief.

- Check whether all lines are securely connected and that they cannot loosen on their own.
- Switch off the current distributor and secure the voltage supply from being unintentionally switched back on. Ensure that the current distributor is de-energised.
- Lay the mains cable from the inverter to the current distributor.
- **WARNING! Risk of fire due to overcurrent and heating of the mains cable.** Install a line circuit breaker into the mains cable between the inverter and the feed meter (see table 6) to secure it against overcurrent.

	PIKO	
	4.2 5.5 7.0 8.3	**10.1**
Type	Three-pole	
Tripping characteristic	B	
Rated current	16 A	25 A

Table 6: *Recommended AC line circuit breaker*

- Do **not** switch on the voltage yet.

8.4 Earth connection (only for France)

For connection in France, the inverter must be earthed as shown in the following illustration.

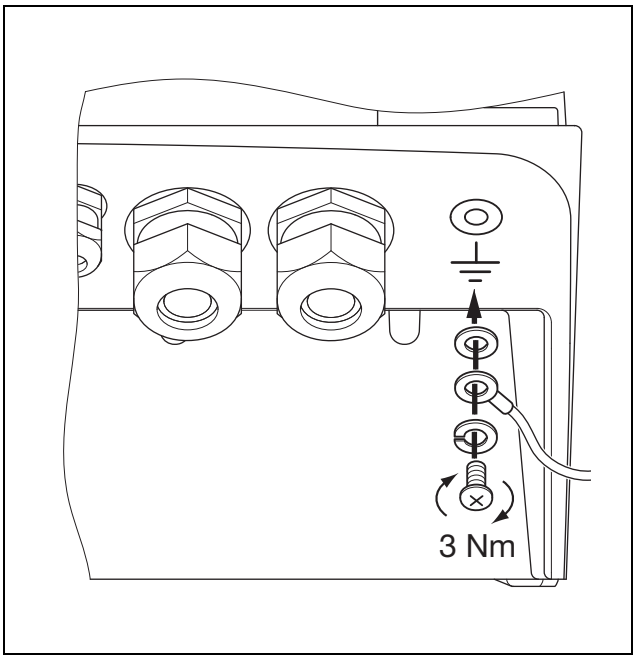


Fig. 16: *Earth connection (only for France)*

8.5 Connecting the DC side

The number of strings to be connected depends on the configuration of the photovoltaic system.

The cross-section of the DC cables should be as large as possible, a maximum of 4 mm² for flexible cables and 6 mm² for rigid cables. We recommend using tin-plated cables. If non-tin-plated cables are used, the copper strands may oxidise, as a result of which the transition resistance of the crimp connections will be too high.

If the rated current of a string is higher than the permitted input value of the inverter, you can, on certain unit types, connect the DC inputs 1 and 2 in parallel (see table 7). Two bridges have been added to the units for this purpose (figure 17).

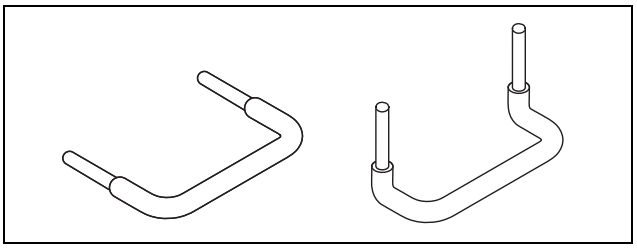


Fig. 17: *DC bridges*

	PIKO				
	4.2	5.5	7.0	8.3	10.1
Number of DC inputs	2	3	2	2	3
Nominal DC current per input [A]	8	8	11.5	11.5	11.5
Max. DC input current per input [A]	9	9	12.5	12.5	12.5
Is parallel connection of inputs 1 & 2 possible?	Yes	No	Yes	Yes	Yes
DC nominal current for parallel connection 1+2 [A]	12	—	20	20	23
Max. DC input current for parallel connection input 1 & 2 [A]	13	—	25	25	25

Table 7: *Connecting inputs in parallel*

The delivery package of the inverter includes plug-in connectors from Multi-Contact (type MC4).

During installation, always observe the **latest specifications from the manufacturer of the plug-in connectors**, e.g. regarding required special tools, permissible tightening torques etc.

Further information is available, for example, online at www.multi-contact.com.

Installing the plugs onto the DC cables

⚠ DANGER

Risk of death due to electrical shock!

The PV lines may be live when the PV field is irradiated.

- Ensure that the DC switch is set to O (OFF). The plug-in connectors may be plugged in and disconnected in this position only.
- Eliminate any existing earth faults or short circuits in the strings.
- Remove 6–7.5 mm of insulation from the DC cables. Be careful not to cut any individual wires.
- Crimp the DC cables according to the recommendations of the plug-in connectors' manufacturer.
- Lead the crimped contacts from behind into the plug or socket insulation until they engage. Make sure to use the provided multi-contact plug-in connectors. Observe the polarity of the cables.
- Pull gently on the cable in order to check whether the metal part has engaged.
- Check that installation has been carried out in accordance with the recommendations of the plug-in connectors' manufacturer.

⚠ DANGER

Injuries can result from destruction of the device!

When the maximum values of the permitted input voltage at the DC inputs of the inverter are exceeded, this can result in serious damage, which can lead to the destruction of the device and to considerable injuries to persons present. Even brief exceeding of the voltage can already cause damage to the inverter.

- Prior to connection of the DC plugs to the inverter, check for the correct planning and wiring of the modules and subsequently measure the DC idling voltage. Please ensure that the maximum permitted DC idling voltage is not exceeded. Log the measurement values. In the event of a complaint, please provide these measurement values.

  Failure to do so will make any warranty, guarantee or liability of the manufacturer null and void when you can not prove that the damage was not due to non-observance.

Inserting DC cables into the inverter

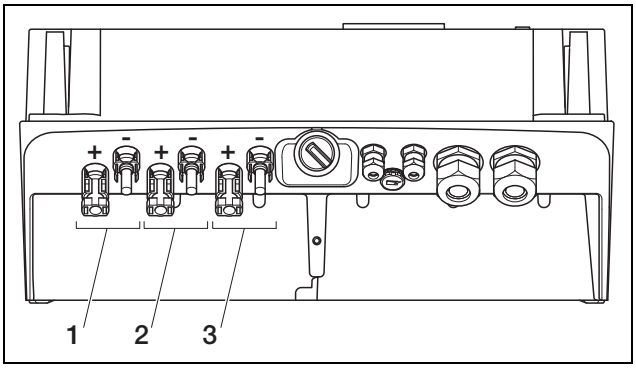


Fig. 18: *DC inputs (the number of inputs which can be used depends on the model)*

1 Plug-in connector couplings DC string 1
2 Plug-in connector couplings DC string 2
3 Plug-in connector couplings DC string 3

- Check that the inverter is de-energised.
- Set the DC switch to OFF.

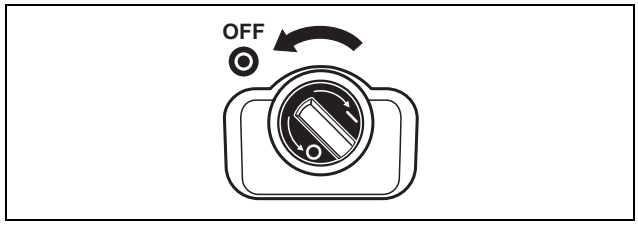


Fig. 19: DC switch OFF

- Remove the two plug seals from the plug-in connectors. Keep the plug seals.
- Insert the PV string plugs until they engage in the corresponding counterparts on the inverter (figure 20).

Note: Fuses for the individual strings are only necessary when more than two strings are connected parallel to an input. In this case, use a fuse in accordance with the specifications of the module manufacturer.

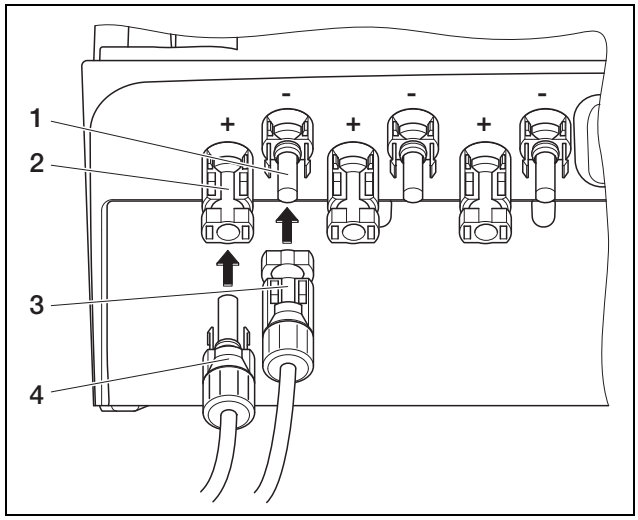


Fig. 20: Connecting the PV string

- Pull on the plugs in order to ensure that they are properly engaged.

Note: To disconnect the plug-in connectors, press the engaging clips together manually or with the tool available from the plug-in connectors' manufacturer and pull the plug out.

- To connect additional strings, repeat the above installation steps for each string.
  Any additional plug-in connectors needed are available from specialist shops.
- PIKO 4.2: If you connect DC input 1 and 2 in parallel, remove the cable ends of the second DC input from the clamping block DC2 and insulate the free cable ends using the caps supplied.
- PIKO 4.2/7.0/8.3/10.1: If required, now connect inputs 1 and 2 **in parallel**. Insert the supplied bridges into the clamps as shown (figure 21/22).

Note: Please note that parallel connection is not possible with PIKO 5.5.

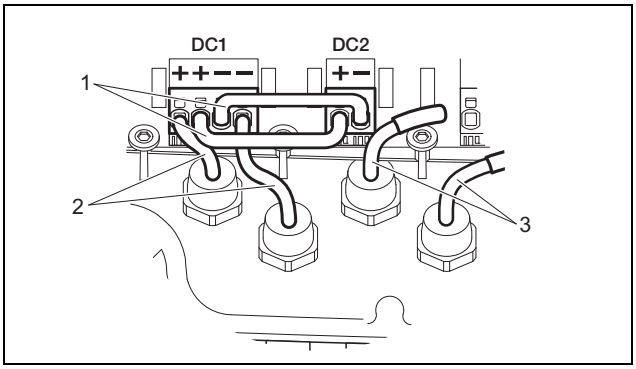


Fig. 21: Inputs 1 and 2 are connected parallel (PIKO 4.2)

1 DC bridges
2 PV string 1
3 PV string 2

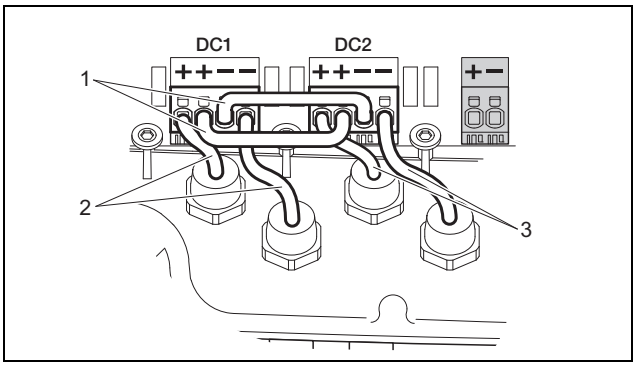


Fig. 22: Inputs 1 and 2 are connected parallel (PIKO 7.0/8.3/10.1)

1 DC bridges
2 PV string 1
3 PV string 2

- Leave the plug seals on the plug-in connectors not in use to protect them from moisture and dirt.

8.6 Connect communication components

Now install the available communication components, such as cable, etc. The GSM modem is an exception, since the PIN code of the SIM card must be entered **before** the GSM modem can be installed in the inverter with the SIM card (see section 9.2.1).

ATTENTION

Ensure that all cables run directly **over** the protective plate, do not protrude over the side of the protective plate and are fastened with cable ties.

⚠ DANGER

Risk of death due to electrical shock!

Single-insulated cables from communication components may come into contact with parts carrying grid voltage if the insulation is damaged.

- Only connect **double-insulated cables** in the inverter.

ATTENTION

The communication board may be damaged by electrostatic discharge.

- Touch a grounded point, for example, the holder for the housing screw connection on the bottom right, before touching the PCB.

8.6.1 Overview of the communications interfaces

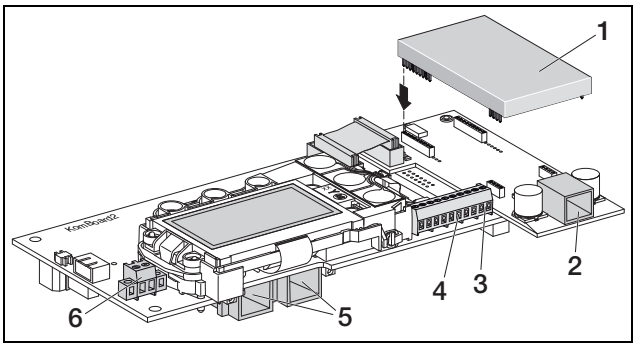


Fig. 23: Communication interfaces

1 Modem (accessory)
2 RJ11 socket
3 Terminal for RS485 interface
4 S0 voltage input
5 RJ45 sockets
6 Switch output (S0/AI OUT)

Connecting Ethernet cable

You can connect the inverter to a computer or a computer network (Ethernet 10/100MBit/s) via the RJ45 socket. Use a CAT6 cable with a max. length of 100m.

- Insert the plug of the Ethernet/crossover cable into one of the corresponding sockets (*5* in figure 23).

8.7 Closing the housing

- Fasten all cables with a cable tie to the recesses in the protective plate.
  Make sure that all cables run directly **over** the protective plate and do not project laterally over the protective plate.

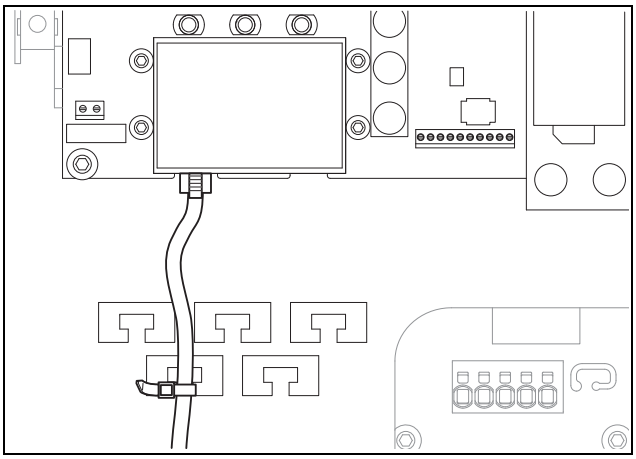


Fig. 24: Fastening cable to protective plate

- Screw all union nuts together with sealing ring tightly onto the cable screw connection. Recommended tightening torques: 1.5 Nm (M12) and 8 Nm (M25).
- Check whether all lines are securely connected and that they cannot loosen on their own.
- Remove any foreign objects from the inverter (tools, wire cuttings, etc.).
- Fit the cover and bolt it tight (5 Nm).

8.8 Set initial commissioning and country of use

For the initial commissioning, sufficient solar irradiation must exist so that a DC input voltage of at least 180 V is available for the inverter.

The country of use must be set so that the network monitoring functions in accordance with the local mains grid.

- Turn the DC switch to ON or switch on the DC strings one after another via the external DC isolator.

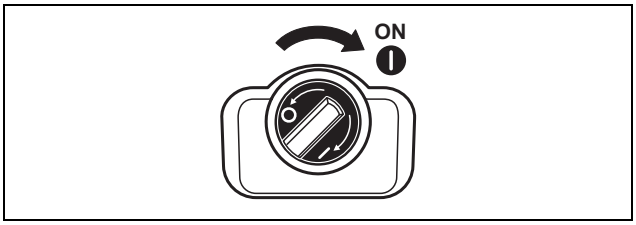


Fig. 25: DC switch ON

- Switch on the grid voltage via the line circuit breaker.

The inverter starts up. After the start up, the three LEDs light up briefly. The inverter can now be operated. The screensaver appears and displays the device type. The screensaver is deactivated when a key is pressed twice.

The menu for the country setting appears on the display.

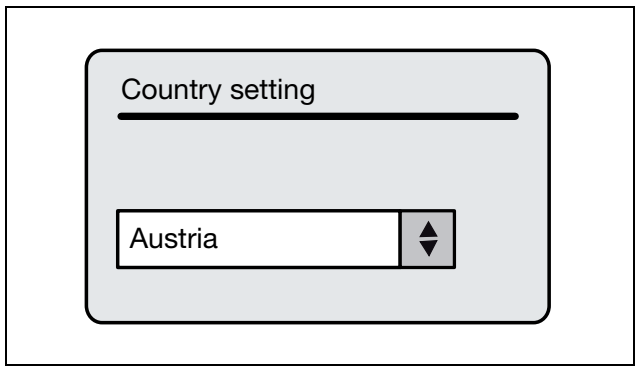


Fig. 26: *Country setting menu*

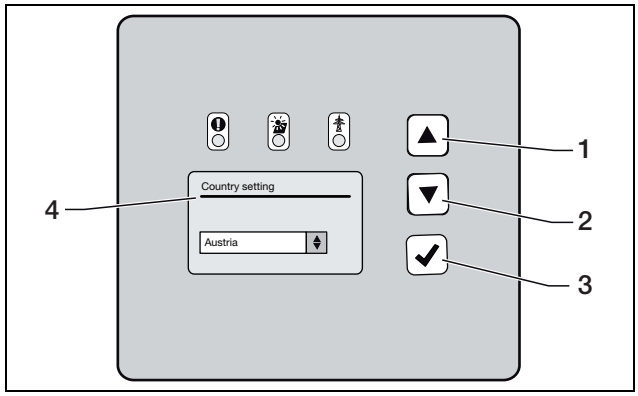


Fig. 27: *Display on the inverter*

- Press the arrow keys (1 or 2) to select the desired country.
- Press the Enter key (3) to go to the confirmation window.
- Press the arrow keys (1 or 2) to switch between "NO" and "YES" choices.
- Press the Enter key (3) to confirm your selection.

Note: The country setting is now permanently fixed. The country setting menu can no longer be called up.

8.8.1 Connecting to the web server of the inverter

- Connect the inverter with a computer as described in the following.
- Set the Ethernet interface (TCP/IP protocol) of the computer so that the IP address automatically obtains the DNS server address. To alter this setting, administrator access rights may be required.
- Start your Internet browser and enter the letter S and the serial number of the inverter in the address bar, for example http://S12345FD323456
  ➜ The log-in window opens.
- Enter user name and password. The factory defaults are set as follows:

User name: pvserver
Password: pvwr

- Confirm the entries by clicking on "OK".
  ➜ The main page of the inverter is displayed.

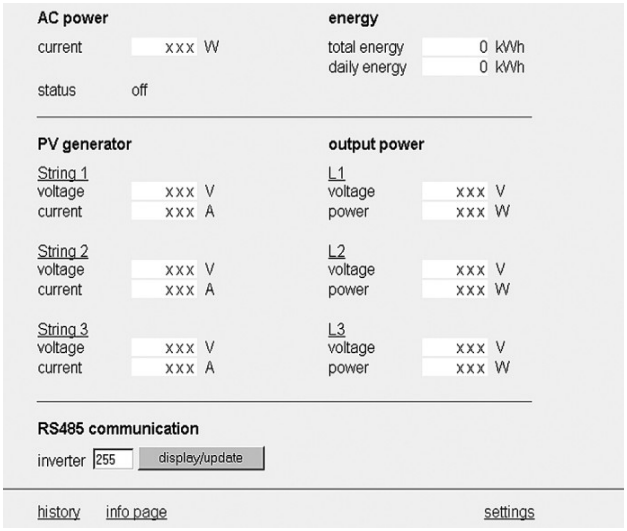


Fig. 28: *Main page of the web server*

Overview of the communications interfaces

In terms of communication options, four different situations are taken into account.

1. Inverter configuration.
2. Direct retrieval of the current yield/power values and/or saved log data.
3. Transfer of the yield/output data to an Internet solar portal.
4. Remote retrieval of the current yield/power values and/or saved log data.

Situation 1: Configuring the inverter

All settings relating to communication, for example, activation of data transfer to a solar portal, can be selected directly via the display or the integrated web server. In order to access the web server for configuration, you require a computer that is connected to the inverter either directly or via the network.

The inverter is equipped with two Ethernet interfaces (RJ45 sockets) for this purpose. The computer must also be equipped with this type of interface. The operating system is irrelevant, as the web server is called up via an Internet browser (e. g. Mozilla Firefox, Microsoft Internet Explorer).

You can then connect the inverter and computer either

a) directly via an Ethernet cable (see illustration 31) or

b) via a local network (switch/hub/router and Ethernet cable, see figure 29).

Version a) is the best option when no switch/hub/router is available.
Version b) is the best option when a local network is already available. Several inverters can also be connected in the network (figure 30).

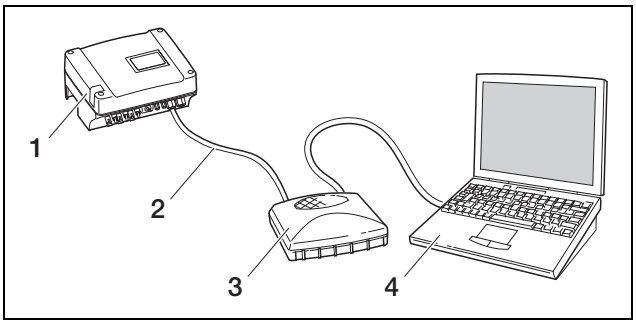


Fig. 29: *Connecting inverter and computer with Ethernet cables and switch*

1 Inverter
2 Ethernet/crossover cable
3 Switch/hub
4 Computer (for configuration or data retrieval)

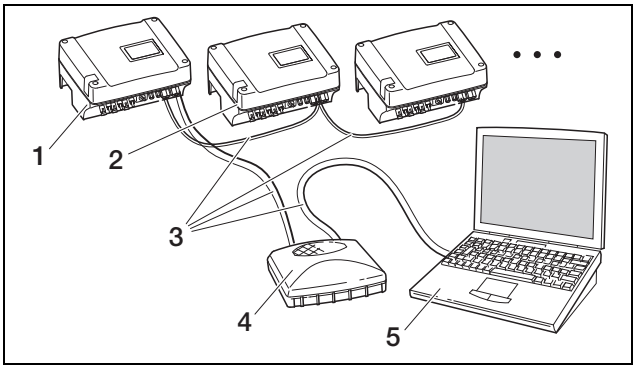


Fig. 30: *Several inverters in the network*

1 Inverter
2 Additional inverters
3 Ethernet/crossover cable
4 Switch/hub
5 Computer (for configuration or data retrieval)

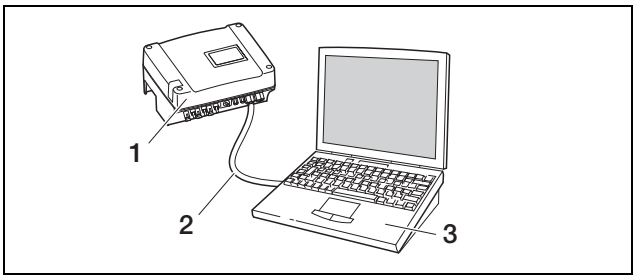


Fig. 31: *Connecting inverter and computer with Ethernet cable*

1 Inverter
2 Ethernet/crossover cable
3 Computer (for configuration or data retrieval)

Situation 2: Direct retrieval of the yield data

Retrieving the saved log data of the inverter is also only possible with a computer. The units are cabled as described under situation 1.

Alternatively, you can connect the inverters to each other via the RS485 interface and then need only connect one of the inverters via Ethernet (figure 32).

With this type of connection, the web server of the inverter connected via the Ethernet also displays the current output data of the other inverters. However, the web server and the stored log data are only available for the inverter connected via Ethernet.

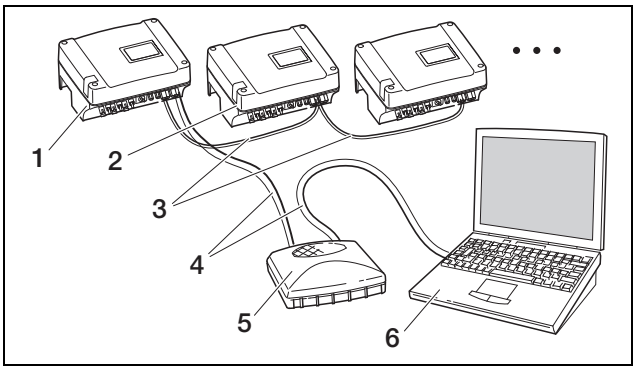


Fig. 32: *Connect inverters via the RS485 and retrieve performance data via Ethernet*

1 Inverter
2 Additional inverters, max. 200 depending on cable length
3 RS485 connection
4 Ethernet/crossover cable
5 Switch/hub
6 Computer

Situation 3: Data transfer to a solar portal

The inverter can send yield data to an Internet solar portal at regular intervals.

To do so,

a) the inverter must be connected to a DSL router or to a network with Internet access
or

b) the inverter must have an integrated wireless modem (GSM) available as an accessory.

Version a) requires a DSL connection. If your inverter is located close to the building and you already have a DSL connection, you can use the available connection for transfer.
In the case of data transfer via DSL, a max. of 300 inverters can be networked.

Note: If the inverters are connected to the Internet by DSL router in the local network, both direct retrieval of the log data as well as transfer of the log data of all connected inverters is possible through a solar portal.

Version b)

To transfer the data to a solar portal with a modem, first connect the inverter via the Ethernet/crossover cable. You will only need one modem: the inverter with the modem then assumes the function of a router for the other inverters.

For version b) with a wireless modem, you will require a SIM card from a mobile phone provider. There must also be adequate wireless reception at the point of installation.

Make sure that the APN (access point name) is set correctly. To do this, use the "Settings" page in the "GSM-Link" configuration tool (see section Installing GSM modem).
You will find a detailed description on our website.

ATTENTION

Inadequate reception quality, e.g. in areas with weak network coverage, can lead to **connection problems** and to the GSM modem **dialling into the grid too often**. Depending on the price model of the GSM contract, this can result in **increased costs**.

The reception quality is also affected by the weather. We recommend testing the reception with a normal mobile telephone for a few days prior to installation to ensure that adequate reception is possible despite differing weather conditions.

Note: The maximum cable length of the GSM antenna is 8 m!

The number of inverters that can be networked is in principle only limited by the available IP addresses. In practice, a maximum of 30 inverters can be networked when transferring data via a GSM modem.

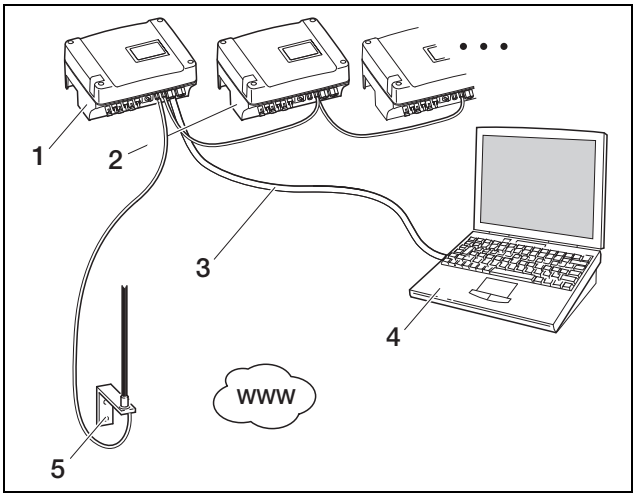


Fig. 33: *Connecting several inverters through the Ethernet and transferring data via modem*

1 Inverter with an integrated modem (GSM)
2 Additional inverters (without a modem), max. 29
3 Ethernet/crossover cable
4 Computer (for configuration and, if applicable, direct retrieval)
5 Mobile communications antenna

Note: For installations with several (max. 30) inverters, you will only need **one** modem.

Situation 4: Remote retrieval of yield data

You can also connect to the inverter remotely instead of through a local network. This may possibly involve additional connection costs.

Similar to situation 3, the inverter must either

a) be connected to a DSL router or

b) have a modem (GSM) installed.

Version a) Inverter with DSL connection to the Internet

To ensure the inverter can actually be accessed via the Internet, several requirements must be met.

— The inverter must have a fixed IP address in the local network.

— Port forwarding must be configured to the inverter IP address in the router.

— The router must be assigned a fixed IP address by the Internet provider or you must register the router with a DynDNS service to connect the dynamic router IP address with a fixed name.
The inverter can then be accessed over the Internet under the domain name provided by the DynDNS service, and you can connect to the inverter with any Internet browser (see figure 34).

Setting up a port forwarding and a DynDNS service can't be illustrated in detail here due to the vast number of different devices and services available.

Note: DynDNS services can also be found under the designation "Dynamic DNS" and "DNS-Host-Service". In order that the router can be reached under the selected domain name, it informs the DynDNS service of each IP address change. Many of the available routers offer such a function, but a router generally only supports certain DynDNS services.
With some router manufacturers the function for port forwarding is called "Virtual Server" or similar.
For further information see the operating instructions of the router.

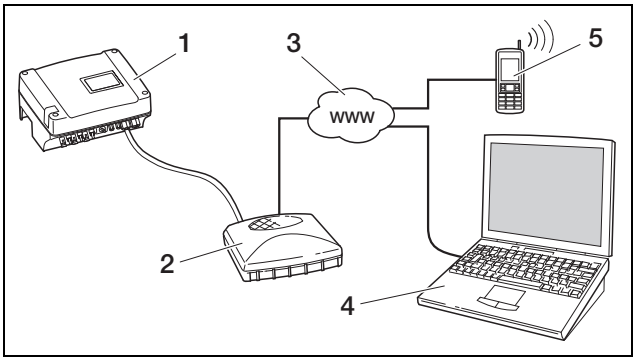


Fig. 34: Retrieving log data: Inverter connected to the Internet via DSL

1 Inverter
2 DSL router
3 Internet
4 Computer
5 Internet-compatible mobile phone with browser function

Version b) with an integrated modem

Dialling in with a computer and analogue telephone connection does not function reliably for an inverter with GSM modem. We therefore recommend dialling in via a computer with a GSM modem or a mobile telephone with a modem function (see figure 35).

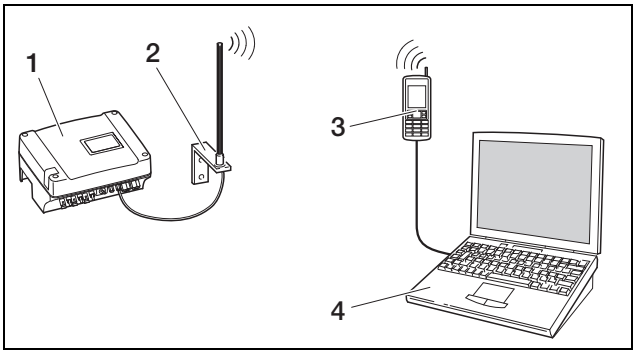


Fig. 35: Retrieving log data: Inverter connected to a mobile communications network

1 Inverter with integrated GSM modem
2 Mobile communications antenna
3 Mobile telephone (GSM) with modem function
4 Computer

Installing GSM modem

In order to use the GSM modem, you will need a SIM card with a contract with a mobile phone provider. The GSM-Link software leaves you free to select your mobile phone provider. Using a modem involves additional costs. Details can be obtained from telecommunications providers.

Not every mobile phone tariff is suitable for use with an inverter!
Before purchasing the SIM data card, discuss the following points with your mobile phone provider and obtain all the access data you require (APN, user name and password).

— You should select a provider whose grid supplies the strongest GSM signal at your chosen location.
— The tariff must allow for packet data communication via GPRS.
— Prepaid cards which are charged by mobile calls are not suitable.
— Tariffs which specify particular times for data downloads cannot be used.
— The tariff must permit a data volume of at least 5 MB per month and inverter.
— The SIM card must be activated before installation.

- Switch the inverter off for **at least 5 minutes**, see chapter 9.4 ‹Disconnecting the inverter /decommissioning›.

There are life-threatening voltages in the inverter in the operating state. Only a qualified electrician may open and perform work on the device.

- Open the cover.
- Connect an Ethernet/crossover cable to the communication board (RJ45 interface (network connection)) and connect this to the PC.
- Fasten the cable in such a way that it cannot come into contact with the AC or DC cables.
- Switch the inverter back on again.
- In the Internet browser, enter the serial number, inverter name or IP address in the address line to go to the inverter's web server (e.g. s081230001 or e. g. PIKO 4.2 or e. g. 192.168.1.1).
- Enter the PIN number on the "Settings" page in the "GSM PIN" field.

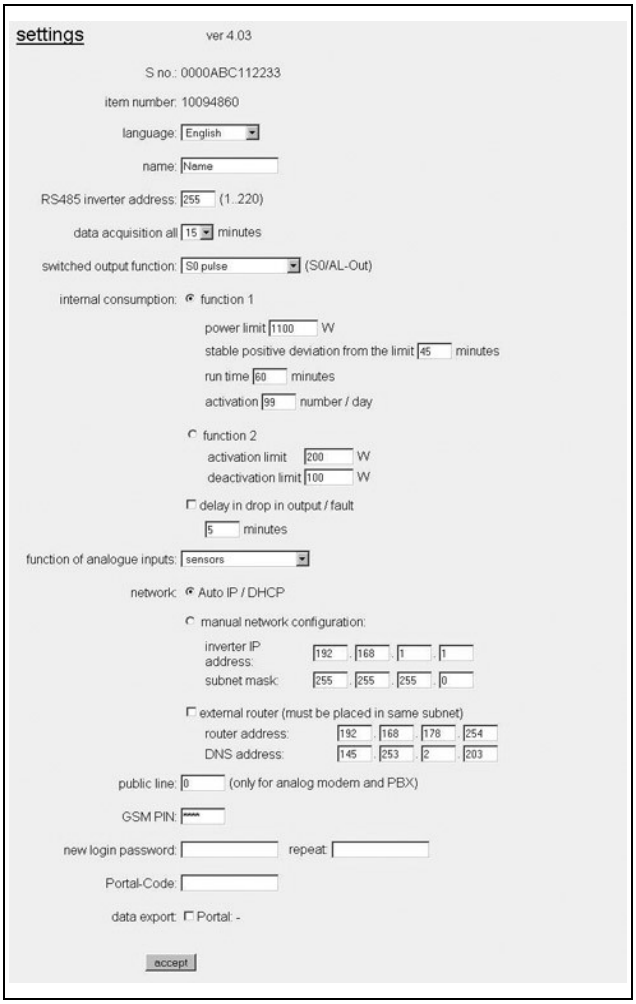


Fig. 36: *Settings page*

- Launch the "GSM-Link" software.

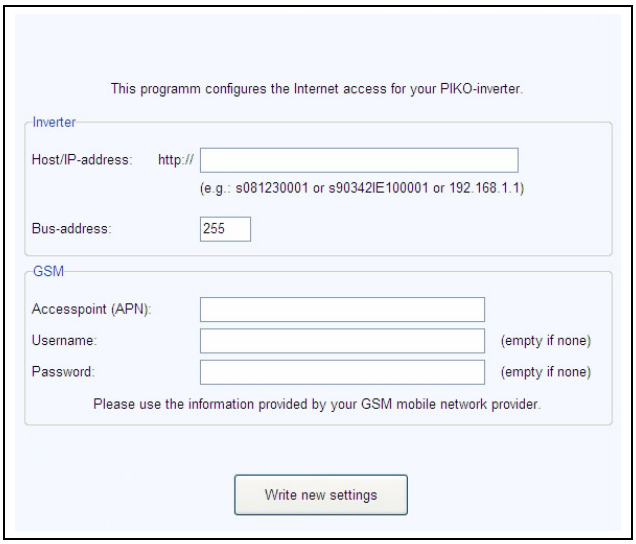


Fig. 37: *GSM -Link*

- Enter the serial number or IP address of the inverter in the "Host/IP address" field (note: enter the letter S and the inverter's serial number, for example http://S12345FD323456.)
- In the GSM area, enter the data (APN, user name and password) of the SIM card in the corresponding fields and confirm by selecting "Write new settings".
- Switch the inverter off for **at least 5 minutes**, see chapter 9.4 ‹Disconnecting the inverter /decommissioning›.
- Slide the SIM card into the card holder on the underside of the modem.
- Carefully attach GSM modem to Pcb. The uppermost plug pin must be inserted into the uppermost hole in the multipoint connector.

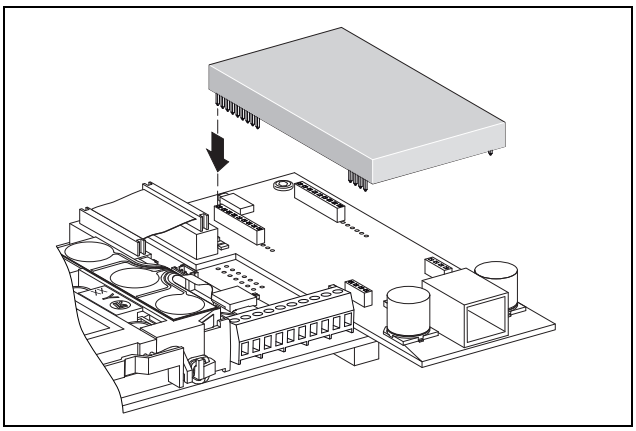


Fig. 38: *Installing the modem*

- Insert the plug of the radio antenna into the GSM modem.
- Install the radio antenna where it will have the best possible reception.
  Note: The reception quality will be displayed on the web server info page after starting up (see section ‹Checking sensors and modem› in chapter 9.2).
- Switch the inverter on again and wait at least 2 minutes.
- In the Internet browser, enter the serial number, inverter name or IP address in the address line to go to the inverter's web server.
- Check whether the modem has adequate reception quality (at least two bars) displayed (GSM modem).

Fig. 39: *Modem status*

- If the "Modem status: GSM signal strength" field is displaying at least two bars, the connection is OK.

Activating data transfer to a solar portal

- The factory setting does not include a solar portal. To use a solar portal, you will need a portal code.

The portal code for the PIKO Solar Portal (www.piko-solar-portal.de) is P3421. The portal code for safer'Sun (www.meteocontrol.com) is P202L.

The portal code can be entered in two ways:

1. Via the web server
2. Via the control panel

Entry of the portal code via the web server

- Open the web server's "Settings" page (see illustration 36).
- Enter the code for the intended solar portal in the "Portal code" field.
- Click on "accept" to save the settings.
  - ➜ The name of the solar portal will appear on the page. The box (☑) next to the portal name was activated automatically.
  - ➜ Data transfer is now activated.

Note: In order to end the data transfer, proceed as follows (see also chapter 11.4 (page 49).

- Open the setting page of the web server.
- Click the box next to the name of the portal to deactivate the data export to the solar portal (☐).
- Click on "Accept" to apply and save the settings.

- Check that the connection is OK.
- The inverter connects automatically to the portal. Enter the words "go online" in the "Portal-Code" field to initialise a manual connection. (see "Entry of the portal code via the control panel" on page 28).
- Confirm by clicking on "accept".
- Open the "Info page".

Info page

1st analogue input	**0.00 V**
2nd analogue input	**0.00 V**
3rd analogue input	**0.00 V**
4th analogue input	**0.00 V**
Modem status	**No modem available**
Last portal connection:	**–**
Number of energy impulses (S0-In):	**0** / 15 minutes

Back to main page

Fig. 40: *Info page*

If a value in minutes is stated in the "last connection to portal" field, there is a connection to the PIKO Solar Portal.

You can then register at the PIKO Solar Portal and use the inverter to create a system or add the inverter to this system.

Entry of the portal code via the control panel

- Call up the "Settings" menu in the main menu.

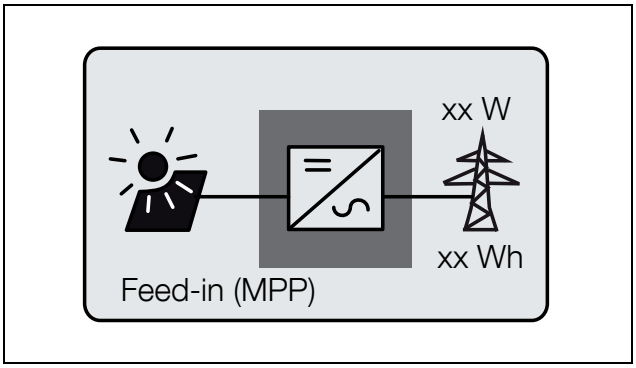


Fig. 41: *Main menu, menu settings selected*

- Go to the "Communication" menu and select the "Portal configuration" menu
- Use the arrow keys to select the "Code:" input box and confirm the selection.

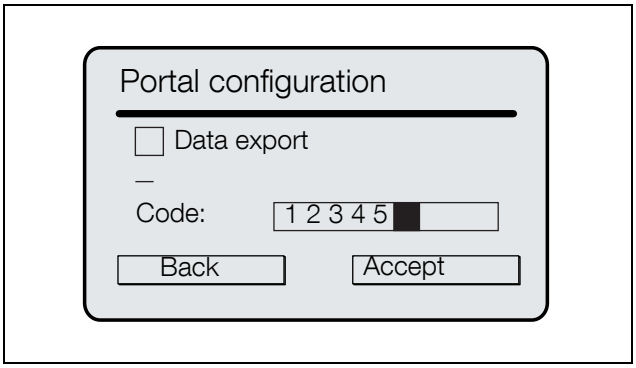


Fig. 42: *Entry of the portal code*

- Enter the portal code (see section "Call up main menu and navigate" on page 41).
- Confirm the entry with the "Accept" function.

The data export is activated (recognisable by the cross in front of Data export). The name of the solar portal is shown. The data export to the solar portal is executed. To end the data transfer, remove the x in front of the portal.

Note: Under normal circumstances, the data becomes visible at the PIKO Solar Portal 20 minutes following the data export. The transfer time can increase when the connection is impaired (e. g. poor wireless connection).

8.9 Installing accessories

If available, now install accessories such as sensors or ripple control receiver.

⚠ DANGER

Risk of death due to electrical shock!

Single-insulated cables from communication components may come into contact with parts carrying grid voltage if the insulation is damaged.

- Only connect double-insulated cables in the inverter.
- Fasten the cable in such a way that it cannot come into contact with the AC or DC cables.

ATTENTION

The communication board may be damaged by electrostatic discharge.

- Touch a grounded point, for example, the holder for the housing screw connection on the bottom right, before touching the PCB.

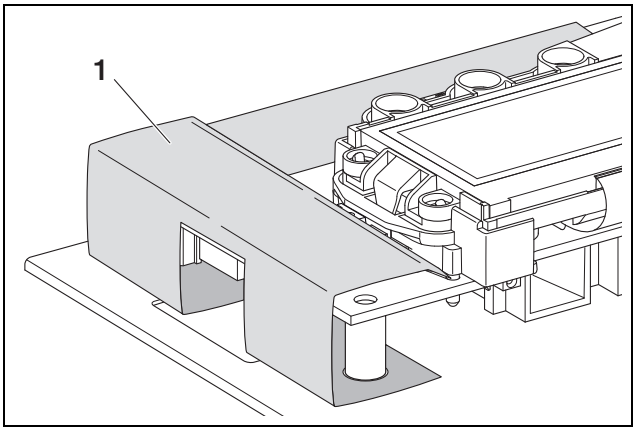


Fig. 43: *Communication board with protective film*

1 Protective film

Note: The communication board is covered with a protective film. Before cables can be connected to the S0/AL-Out, the film must be removed and then mounted again.

Overview of the accessory interfaces

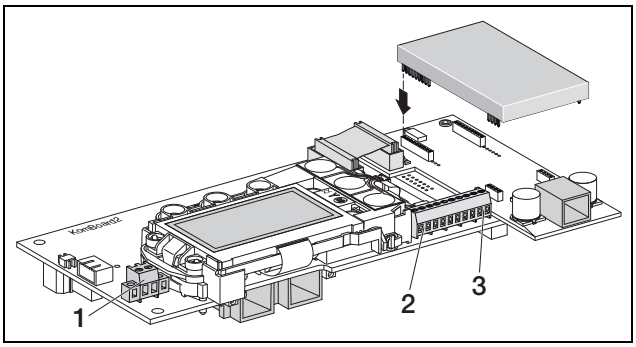


Fig. 44: *Connections*

1 Switch output (S0/AI OUT)
2 Terminal for analogue interfaces
3 RS485 interface

Connect switch output (S0/AI OUT)

The switch output S0/AI-OUT can be occupied with the following functions via the settings page in the web server:

— S0 interface
— Alarm output
— Switching of devices (internal consumption)

S0 interface: The switch output functions as a pulse output as described in DIN EN 62053-31 with a constant rate of 2,000 pulses per kilowatt hour. Using a suitable receiver device, such as an energy meter or a display, you can record and display the energy yield of your photovoltaic system.

Alarm output: The switch output functions as a potential-free NC contact. It opens when a malfunction occurs (see ‹Faults› on page 44).

Internal consumption: The switch output functions as a potential-free NO contact. It closes when the set conditions are fulfilled (see section ‹Setting conditions for switching on consumers (internal consumption)› on page 34).
For more information, refer also to the text and image in section ‹Internal consumption›, on page 12.

Max. load	100 mA
Max. voltage	250 V (AC or DC)
Connections	Neutral polarity

Table 8: *Switch output technical data*

Note: You must install a component such as an external load relay between the inverter and the consumer device. Do not connect any consumer devices *directly* to the switch output.

- Connect the lines to the appropriate terminals (fig. 44, position 1).

Connecting the S0 input (energy pulse meter)

The S0 input allows you to record the pulses of an energy meter or a second inverter.

When using the S0 input, the analogue inputs AIn3 and AIn4 are inactive. The web server of the inverter shows the pulses counted on the info page.

- Connect the lines to the terminal (4 in figure 9) according to the connection assignment (table 46).

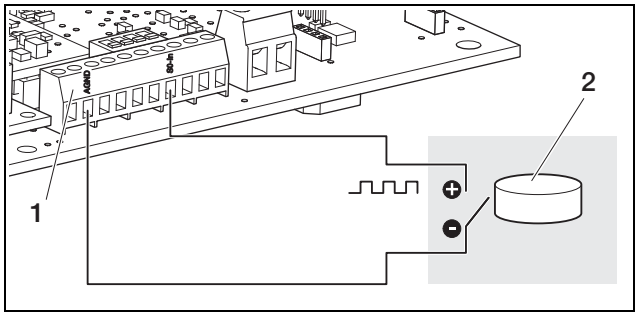


Fig. 45: *Example of the connection of an external energy meter at the S0 In input*

1 S0 In input
2 External energy meter

Connecting analogue sensors

The inverter features four analogue inputs to which you can connect, for example, temperature and irradiation sensors or wind sensors. The additional measured data enable a more precise monitoring of the photovoltaic system.

The sensors must have an output voltage of 0...10 V. An additional voltage supply may be required, depending on the sensor.

Note: When using the S0 input, the analogue inputs AIn3 and AIn4 are inactive.

Note: If the inverter is intended for connecting a ripple control receiver, you cannot connect sensors.

- Connect the lines to the terminal according to the connection assignment (figure 46 and table 9).

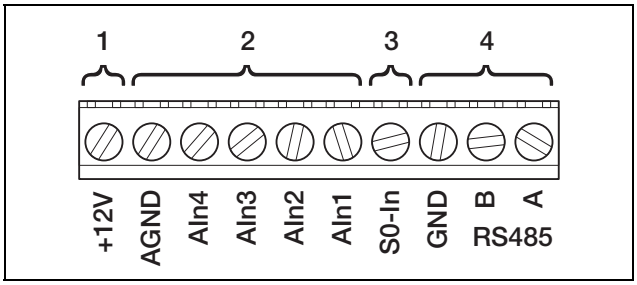


Fig. 46: *Cable terminal*

1 Voltage output
2 Analogue inputs
3 S0 input (energy pulse meter)
4 RS485

Terminal	Designation	Description
1	RS485 A	RS485 A
2	RS485 B	RS485 B
3	GND	Ground for RS485
4	S0 In	S0 input (energy pulse meter)
5	AIn1	Inputs for analogue sensors (0...10 V) or for ripple control receivers
6	AIn2	
7	AIn3	
8	AIn4	
9	AGND	Ground for analogue inputs and S0 input
10	+12V	12 V output for external sensors (not potential-free; max. 100 mA) or for ripple control receivers

Table 9: *Cable terminal connection assignment*

Connecting a ripple control receiver for active power control

Note: The information in this section applies only to systems in Germany.

The inputs for analogue sensors can be used to connect a ripple control receiver for active power control (in accordance with the Renewable Energy Law, as applicable in Germany). This function must be activated via the web server of the inverter to which the ripple control receiver is connected (master) (see section ‹Setting the analogue input functions› in chapter 9.2.1).

The inverter must then be linked via Ethernet or RS485 (figure 47) so that the inverter connected to the ripple control receiver can forward the information received to the other inverters.

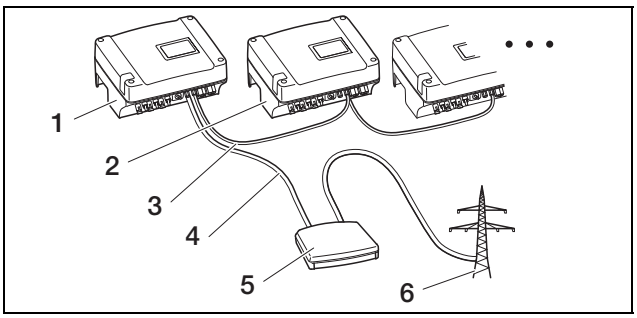


Fig. 47: *Connecting the ripple control receiver for inverters with Ethernet or RS485 connection*

1 Master inverter
2 Additional inverters
3 Ethernet cable, alternatively RS485 connection (3-conductor)
4 5-conductor connection at analogue-in
5 Ripple control receiver
6 Grid

- Connect the ripple control receiver lines in accordance with the connection assignment (figure 48 and table 9).

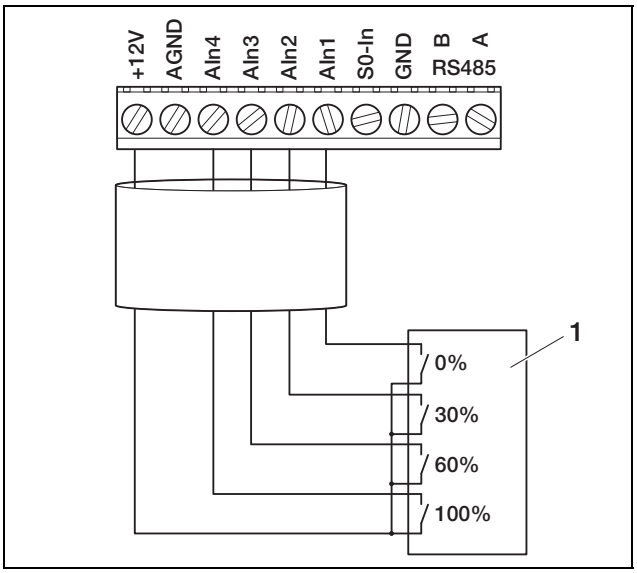


Fig. 48: *Connecting the ripple control receiver to the inverter*

1 Ripple control receiver

Connecting RS485

Connections for the serial **RS485 interface** are found on the terminal for analogue interfaces (figure 46). Using RS485, up to 200 inverters - depending on the inverters used - can be connected.
Additional components can be connected to RS485. An additional level converter may be required in some cases. Use a shielded line for the connection.

To do this, you must set the bus bias voltage and bus termination menu items in the user menu to ON (fig. 66).

Cable lengths of up to 500 m are possible.

Note: If other RS485 units are connected in a RS485 network in addition to the inverters (e. g. a display), the number of inverters which can be connected and the maximum cable lengths may be limited.

- For the connection, activate the bus bias voltage in the user menu of the first inverter and the bus termination in the user menu of the first and last inverters.

Note: If you have the necessary expertise, you can connect the inverter to a serial interface (RS232 or USB) of your computer via a signal level converter. For this type of connection, however, only the current performance data can be accessed. The integrated web server and the stored log data are not available.

- Connect the lines to the terminal (*4* in figure 9) according to the connection assignment (table 46).

8.10 Commissioning

For the initial commissioning, sufficient solar irradiation must exist so that a DC input voltage of at least 180 V is available at the inverter.

- Turn the DC switch to ON or switch on the DC strings one after another via the external DC isolator.

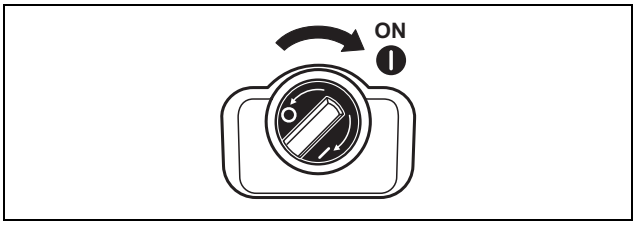


Fig. 49: *DC switch ON*

- Switch on the grid voltage via the line circuit breaker.

The inverter starts up. After the start up, the three LEDs light up briefly. The inverter can now be operated. The screensaver appears and displays the device type. The screensaver is deactivated when a key is pressed twice.

9 Commissioning and de-commissioning

9.1 Switching on the inverter

- Turn the DC switch to ON or switch on the DC strings one after another via the external DC isolator.

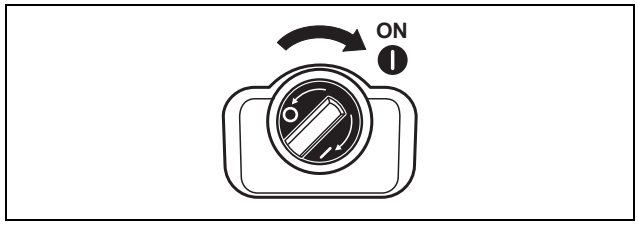


Fig. 50: *DC switch ON*

- Switch on the grid voltage via the line circuit breaker.

The inverter starts up. After the start up, the three LEDs light up briefly. The inverter can now be operated. The screensaver appears and displays the device type. The screensaver is deactivated when a key is pressed twice.

The main menu appears on the display.

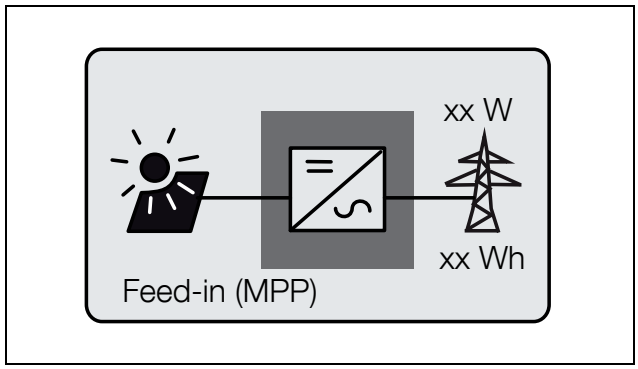


Fig. 51: *Main menu, menu settings selected*

Now you can call up the menus, retrieve data and adjust settings with the control buttons (see menu structure as of page 42).

The yellow LED lights up and the device automatically carries out the required tests according to DIN VDE 0126. If the yellow LED does not light up, the input voltage may be too low.

When the tests have been successfully completed, the green LED lights up and the inverter begins feeding in current to the grid.

If the green LED does not light up, the input voltage or the power may be too low or a fault has occurred (see the chapter "Fault correction").

Note: The time of day must be set on the inverter (see "Settings menu" on page 43). This ensures that the downloaded log data have the correct time entry. When the inverter is connected to a PIKO Solar Portal, the time of day of the PIKO Solar Portal will be adopted.

9.2 Setting up communication and accessories

Perform the remaining set-up using the web server of the inverter.

Note: You can change all settings which you make at any time and as often as you like with the exception of the country of use.

9.2.1 Configuring settings

- Click on the "Settings" link.
  ➜ The "Settings" page is displayed.

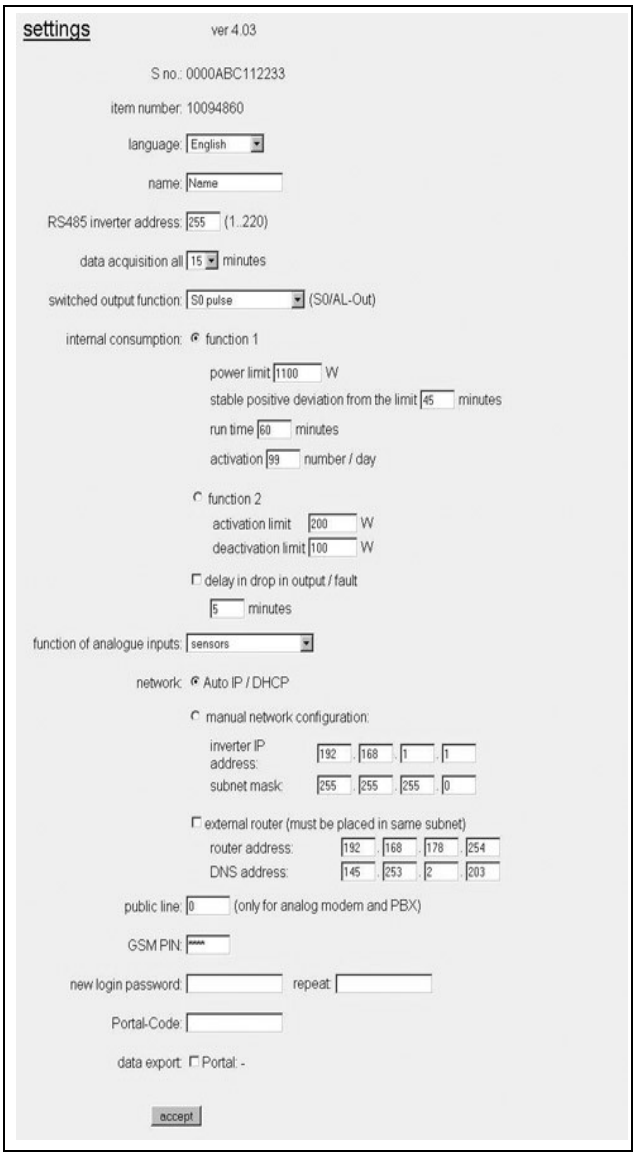


Fig. 52: *Settings page*

Setting	Explanation
S-no.	Inverter serial number
Item number	Item number of the inverter
Language	Selection of the language for the web display
Name	Allocation of a name to the inverter
RS485 inverter bus address	Unit address for the RS485 interface
Data acquisition	Choose between a saving interval of 15 or 60 minutes
Switch output function	Three settings possibilities: – S0-Pulse – Alarm output – Internal consumption

Table 10: *Web server settings*

Setting	Explanation
Function of analogue inputs	Two setting possibilities: – Sensors – Active power control (connection of a ripple control signal receiver)
Network	Configuration of the inverter network interface (Ethernet)
Public line	Only required when using an analogue modem (optional accessory) and an analogue telephone system
GSM PIN	PIN for the GSM modem SIM card. For further information on configuration and installation of the GSM modem, see chapter 8.6.
New log-in-password	Change of password
Portal code	Entry field for the portal code for changing the solar portal displayed under 'data export'
Data export	Activation of data transfer to the solar portal displayed (☑) or deactivation (☐)

Table 10: *Web server settings (cont.)*

Changing the language

You can select a different language for the web server from the drop-down list.

- Select the intended language.
- Click on "Accept" to save the settings.

Changing the name

You can assign a name of your own choosing to the inverter. When connecting the browser to the web server you can then use the name instead of the serial number. Access with the serial number remains possible.

- Type in the name you have chosen. The characters a–z, A–Z and 0–9 are allowed. Umlauts, spaces or special characters are not possible.
- Click on "Accept" to save the settings.

Note: Make a note of the new name for the inverter. The name is also shown in the display of the inverter in the "Settings" submenu and can be changed there.

Configuring the RS485 address

If you have linked two or more inverters via RS485, you must set the RS485 addresses of the inverter so that each address is unique.

- Enter the desired address in the field "Inverter bus (RS485) address".
- Click on "Accept" to save the settings.

Changing the data capture (saving interval)

When selecting the saving interval, you have the option of a 15-minute or 60-minute period between the saving procedures. The internal memory can store the data for approximately 100 days if the 15-minute period is selected and for about 400 days with the 60-minute period.

The inverter data are saved in the device only for a limited time. When the internal memory is full, the oldest data will be overwritten.

To save the data on a long-term basis, you can either transfer the data to a solar portal or download them to a computer.

- Select the desired saving interval.
- Click on "Accept" to save the settings.

Setting the switch output function

- Select from the following options:
  - S0 pulses
  - Alarm output
  - Internal consumption, see section "Setting conditions for switching on consumers (internal consumption)" on page 34
- Click on "Accept" to save the settings.

Setting conditions for switching on consumers (internal consumption)

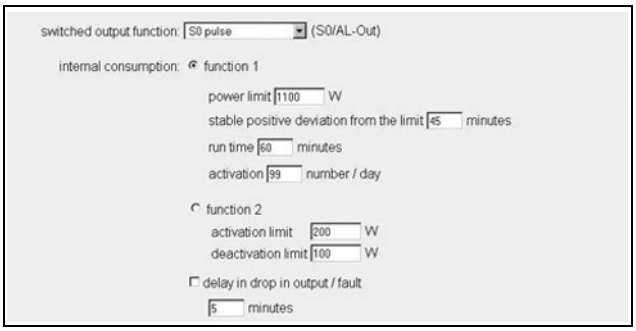


Fig. 53: *Setting conditions for internal consumption*

- Choose between functions 1 or 2 and enter values.
  - Function 1

Power limit	This is the minimum power (in watts) that must be produced before the consumer is switched on. You can enter any value from 1 watt to 999,000 watts.
Stable exceeding of the limit	This is the period (in minutes) during which the inverter must produce at least the power set in the "power limit" before the device is switched on. You can enter any value from 1 minute to 720 minutes (= 12 hours).
Run time	The connected consumer is switched on for this period (in minutes) when both of the above conditions have been met. You can enter any value from 1 minute to 1440 minutes (= 24 hours). The run time ends when the inverter shuts off. The run time is ended and not continued again if the inverter has not produced any current for three hours.
Activation	The number indicates how often internal consumption is activated each day.

Table 11: *Internal consumption function 1*

  - Function 2

Activation limit	This is the minimum power (in watts) that must be produced before the consumer is switched on. You can enter any value from 1 watt to 999,000 watts.
Deactivation limit	The consumer is switched off when the power generated falls below this value.

Table 12: *Internal consumption function 2*

– Delay in drop in output / fault

Short term interruptions or drops in output can occur during operation. In order that these events do not result in the disconnection of the device, a delay time can be set. Following the set period, the inverter shuts the consumer off in the event of an enduring fault or drop in output.

- Click on "Accept" to save the settings.

Setting the analogue input functions

- Select whether the analogue inputs should be used for connecting sensors or a ripple control receiver for active power control.
- Click on "Accept" to save the settings.

Configuring the network

As the standard default setting, the option "Auto IP / DHCP" is activated. This means that the inverter acquires its IP address from a DHCP server or automatically generates itself an IP address in the area 169.254.XXX.XXX. A DHCP server can be, for example, a DSL router. A DHCP server (Dynamic Host Configuration Protocol) is a service that administers and distributes the IP addresses and the network configuration in a network.

Note: The "External router" option must be activated in the web server for an Internet connection with a DSL router.

Manual network settings of the inverter:
Entering the IP address of the router and the address of the DNS server in the web server

automatic network settings of the inverter: When a DHCP server is present, the inverter determines the IP address of the router and the DNS server automatically. In the following two cases, the network settings must be entered manually:
- problems establishing an Internet connection
- no DHCP server for generating the IP address

- The "Auto-IP/DHCP" option is suitable for most applications (figure 54).

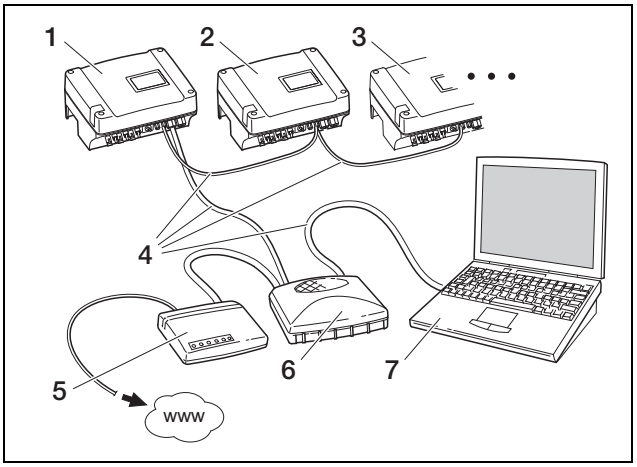


Fig. 54: *Network settings with automatic network configuration for an external DSL router (◉ Auto IP/DHCP, ☑ external router)*

1 Inverter 1 – Auto-IP / DHCP
2 Inverter 2 – Auto-IP / DHCP
3 Inverter 3 – Auto-IP / DHCP
4 Ethernet cable
5 DSL router – with DHCP server
6 Switch/hub
7 Computer with network setting "Obtain IP address automatically"

Network with fixed IP addresses

A fixed IP address assignment ("Manual network configuration" setting) is only required in a few cases:

— You have a local network (Ethernet) with fixed IP addresses and want to integrate the inverter into the network (figure 55).

— Or you operate the inverter through a DSL connection with router and want to connect to the inverter remotely via the router (figure 56).

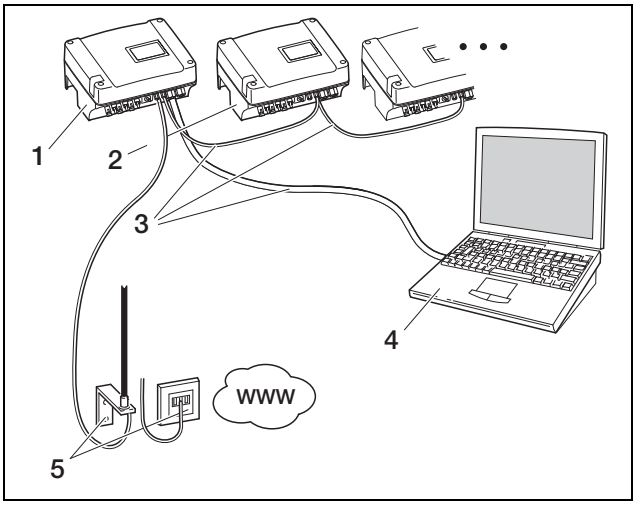


Fig. 55: *Network settings with manual network configuration for GSM communication, subnet mask 255.255.255.0 (☐ external router)*

1 *Inverter with integrated modem (GSM) – inverter 1 – IP address, e.g. 192.168.1.2*
2 *Optional additional inverters (without modem) – inverter 2 – IP address, e.g. 192.168.1.3*
3 *Ethernet cable*
4 *Computer – IP address, e.g. 192.168.1.250*
5 *Telephone connection or mobile communications antenna*

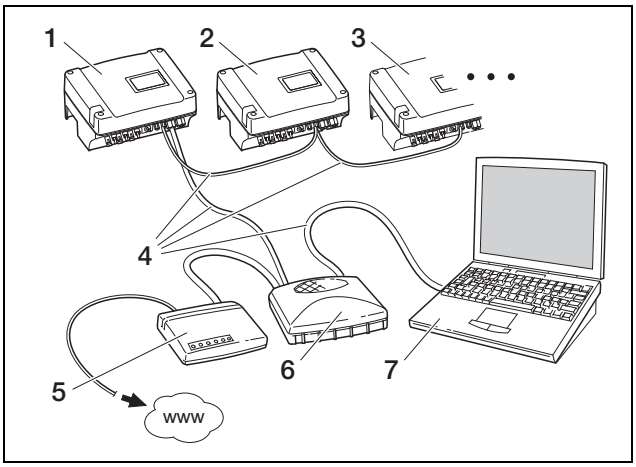


Fig. 56: *Network settings with manual network configuration for external DSL router, subnet mask: 255.255.255.0, ☑external router*

1 *Inverter 1 – IP address, e.g. 192.168.1.2*
2 *Inverter 2 – IP address, e.g. 192.168.1.3*
3 *Inverter 3 – IP address, e.g. 192.168.1.4, etc.*
4 *Ethernet cable*
5 *DSL router – IP address, e.g. 192.168.1.1*
6 *Switch/hub*
7 *Computer – IP address, e.g. 192.168.1.250*

Note: The factory default setting of the DNS server address is 145.253.2.203, and it provides the alternative name resolution in the Internet. Do not change this setting, as the export of log data to a solar portal may otherwise not function any more.

- Activate the "Manual network configuration" setting if you wish to assign a fixed IP address. Enter the IP address and subnet mask.

Note: The changed settings take effect immediately upon clicking on "Accept". Your inputs may have the consequence that the inverter is no longer accessible through the current connection.

- Click on "Accept" to save the settings.
- If the inverter is to use an external router to send data to a solar portal, activate the option "external router" and enter the IP-address of the router.
- Click on "Accept" to save the settings.

Entering the PIN code (for GSM modems only)

You must enter the PIN code that you received from your mobile phone provider in the configuration of the inverter **before** you install the GSM modem with the SIM card.

- Enter the PIN code of the GSM card.
- Click on "Accept" to save the settings.

Note: If you subsequently change your mobile phone provider, **first** enter the new GSM PIN in the web server of the inverter and **then** replace the SIM card in the GSM modem.

Changing the password

You can change the pre-set log-in password on the integrated web server.

- Type in the intended password. The characters a–z, A–Z and 0–9 are allowed. Umlauts, spaces or special characters are not possible.
- Type the password into the "Repeat" field again.
- Click on "Accept" to save the settings.

Note: Your old password becomes invalid immediately after the password change. You should therefore note the password as a precaution.
Forgotten the password? Our customer service is on hand to assist.

Note: The user name cannot be changed.

9.2.2 Checking sensors and modem

- On the main page of the web server, click on the "Info page" link.
  ➜ The "Info page" window opens.

Info page

1st analogue input	**0.00 V**
2nd analogue input	**0.00 V**
3rd analogue input	**0.00 V**
4th analogue input	**0.00 V**
Modem status	**No modem available**
Last portal connection:	–
Number of energy impulses (S0-In):	**0** / 15 minutes

Back to main page

Fig. 57: *Info page*

Entry	Explanation
x- analogue input	Shows the voltage which is currently available on the analogue input x
Modem status	Shows the modem status: – When the analogue modem is connected correctly, "Analogue modem identified" is displayed. – When the GSM modem is connected correctly, the GSM signal strength is displayed. – When the modem is connected incorrectly or not available, "No modem available" is displayed.
Last portal connection	Displays how many minutes ago the inverter last transferred data to the solar portal (when the function is active)
No. of energy pulses	Displays the number of energy pulses per time unit occurring at the S0 interface

Table 13: *Info page*

- Check whether the modem has adequate reception quality (at least two bars) displayed (GSM modem).

Modem status: GSM signal strength ■■□□□

Fig. 58: *Modem status*

- When the reception quality is too low, try another location for the GSM antenna.
  Please note that the reception quality also depends upon weather conditions.

Note: Reception quality which is inadequate can lead to connection problems and to the GSM modem dialling into the grid too often. Depending on the price model of the GSM contract, this can result in increased costs.

- Click on "Back to home page" to display the home page again.

9.2.3 Disconnecting

- Close the browser window to disconnect from the web server of the inverter.

9.3 Handover to the operator

After successful installation and commissioning, give the inverter and this manual to the operator. Advise the operator about the following points:

- The position and function of the DC switch or the external DC isolator and the AC line circuit breaker.
- Safety when handling the device.
- Appropriate procedure when checking and servicing the unit.
- Meaning of the LEDs and the display messages.
- Contact person in the event of a fault.

9.4 Disconnecting the inverter /decommissioning

When carrying out maintenance and repair work, the inverter must always be de-energised and secured against being switched on again.

The inverter is only de-energised after the following work steps have been carried out.

⚠ IMPORTANT INFORMATION

These work steps must be performed before carrying out any work on the inverter!

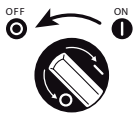
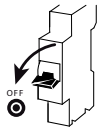
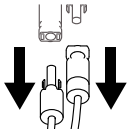
1.		Switch off DC switch
2.		Switch off line circuit breaker For internal consumption: Switch off line circuit breaker for the control of internal consumption.
3.		Secure it against reactivation.
4.		Disconnect DC lines
5.		Wait five minutes (discharge time of the capacitors)

Table 14: *De-energise the inverter*

The following dangers exist when working on the inverter:

	**Danger due to electrical shock!** Always disconnect the device from the power supply during installation and before maintenance and repairs (see Table 3).
	**Danger due to electromagnetic fields!** Persons with pacemakers, metallic implants or hearing aids should avoid proximity to systems with inverters.
	**Risk of burns from hot parts!** Some of the inverter components can reach temperatures of over 80 °C during operation. Do not touch hot components.
	**Risk of fire due to hot parts!** Be absolutely sure to observe the conditions in the "Installation" chapter (page 15) when choosing the installation location.
	**Burns from arcs!** Cables must never be removed from the device during operation as this can cause dangerous arcs. First de-energise the DC side, then remove plug-in connectors!
	**Danger due to electrical discharge!** Wait five minutes after de-energising the inverter!
	**Warning! Property damage!** Property damage to the device, lost earnings or increased telephone fees can result. The instructions refer precisely to the type of and remedy for potential property damage.

Table 15: *Warning symbols*

9.5 Servicing/maintenance

⚠ DANGER

Risk of death due to improperly performed work!

Work performed improperly can cause life-threatening situations. Only qualified electricians or appropriately trained persons may perform work on the inverter.

Once correctly installed, the inverter operates nearly maintenance-free.

- Check the cable connections and plugs at least once a year.
  If there are loose connections, damaged cables, etc., switch off the inverter immediately.

Damage may only be repaired by qualified electricians.

Fan cleaning

For cooling during operation, inverters are equipped with one or two regulated fans. To ensure that the fans function properly, you should regularly perform a test of the fans. If the fans are dirty, the inverter may not be adequately cooled and the degree of efficiency of the unit decreases.

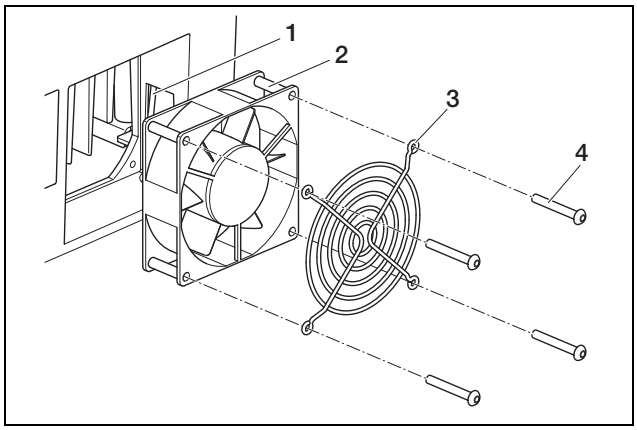


Fig. 59: *Dismantle fan (PIKO 4.2/5.5)*

1 Fan cable
2 Fan
3 Fan grille
4 Screws

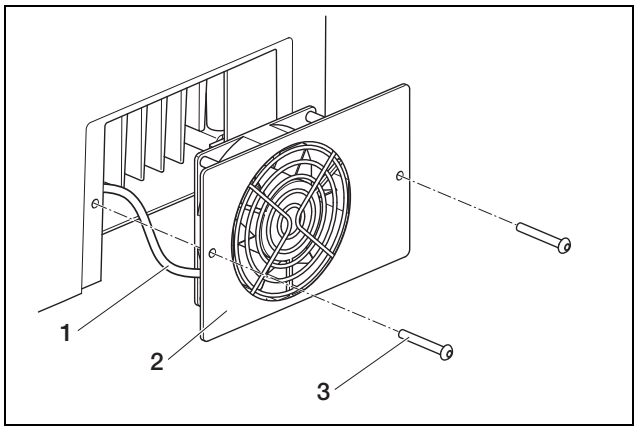


Fig. 60: *Dismantle fan (PIKO 7.0/8.3/10.1)*

1 Fan cable
2 Fan plate with fan and grille
3 Screws

If the fan does not run properly, it should be cleaned. To do so, you must switch off the inverter:

⚠ DANGER

Risk of death due to electrical shock!

There are life-threatening voltages in the inverter in the operating state.

- Switch off the device completely (DC side and AC side) before commencing any work.
- Wait at least five minutes after switching off until the capacitors have discharged.

- Switch off the inverter as described in chapter 9.4.

You can now clean the fan:

- PIKO 4.2/5.5: Loosen the screws (*4* in fig. 59) and carefully remove the fan grille and the fan.
  PIKO 7.0/8.3/10.1: Loosen the screws (*3* in fig. 60) and carefully remove the fan plate.
- Disconnect the fan cable plug connection.
- Clean the fan with a soft brush.
- PIKO 4.2/5.5: Reinsert the fan cable, place the fan back into the housing and screw the fan and the fan grille on.
  PIKO 7.0/8.3/10.1: Reconnect the fan cable and screw the fan plate back onto the housing.

You can now switch the inverter back on:

- Turn the DC load break switch to ON or switch on the DC strings one after another via the external DC isolator.

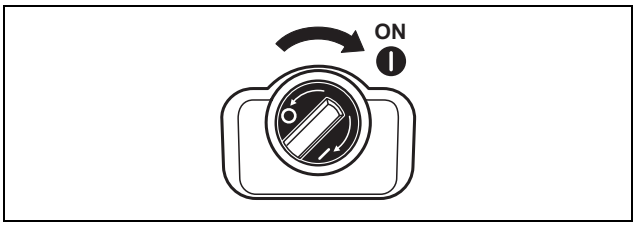


Fig. 61: *DC load break switch ON*

- Switch on the grid voltage via the line circuit breaker.

9.6 Disassembly and disposal

To disassemble the inverter, proceed as follows:

⚠ DANGER

Risk of death due to electrical shock!

There are life-threatening voltages in the inverter in the operating state.

- Switch off the device completely (DC side and AC side) before commencing any work.
- Wait at least five minutes after switching off until the capacitors have discharged.

- Switch off the inverter as described in chapter 9.4.
- Open the cover of the inverter.
  Loosen the terminals and cable screw connections and remove all DC and AC-cables.
- Close the cover of the inverter.
  Loosen the screw on the underside of the inverter and lift the inverter off the wall mount.
- Disassemble the wall mount.

Disposal

Dispose of the inverter properly and in accordance with the applicable regulations.

The box of the inverter is made of cardboard and can be recycled as paper. Plastic parts and the packaging sack can be sorted to plastic recycling.

10 Inverter operating characteristics

The inverter will work automatically after commissioning, meaning that regular operation is not necessary.

As soon as the photovoltaic modules generate sufficient current, the inverter begins feeding into the mains grid in Switzerland.

10.1 Display field

The inverter indicates the respective operating status through three LEDs and an display. You can also retrieve operating values and enter settings on the display.

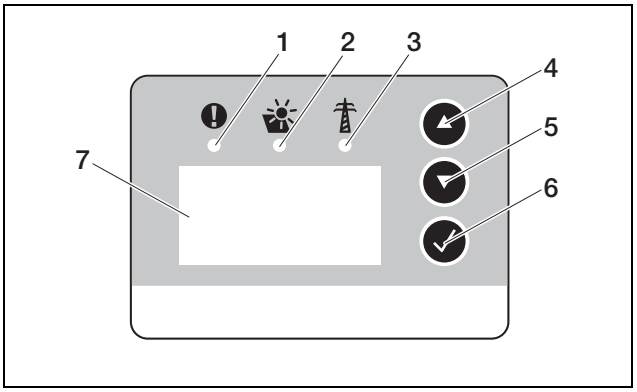


Fig. 62: *Control panel components*

1 "Fault" LED (red)
2 "DC" LED (yellow)
3 "AC" LED (green)
4 "UP" arrow key
5 "DOWN" arrow key
6 Enter key
7 Display

Note: The screensaver appears on the screen when you have not pressed a key for several minutes.

10.2 Determine the operating status (operating LEDs)

The LEDs on the front of the device indicate the current operating status.

LED	Explanation
"AC" LED lit green	The green LED signals that the inverter is in feed-in operation mode if the output voltage of the photovoltaic module is more than 180 V.
"DC" LED lit yellow	The yellow LED signalises the active status of the inverter control system. It lights as soon as the output voltage of the photovoltaic modules exceeds 100 V. When the output voltage falls below 100 V, the yellow light goes out. Once energy is being fed into the mains grid, the yellow "DC" LED goes out and the green "AC" LED lights up.
No LED is lit	The device is operationally ready but the input voltage is less than 100 V. OR: The device is switched off.
"Fault" LED lights up or flashes red OR: "DC" LED flashes yellow	A fault has occurred. Remedial measures can be found in chapter 10.5.

Table 16: *LED indicators in operation*

10.3 Determining the operating status (display)

The operating statuses are shown on the display.

Display	Explanation
Off	Input voltage on the DC side (photovoltaic modules) is too low
Standby	Electronics are ready for operation, DC voltage is still too low for feed-in
Starting	Internal control measurements according to VDE 0126
Feed-in (MPP)	Measurement successful, MPP control (MPP = maximum power point) active
Feed-in regulated	Feed-in power has been regulated due to excessive device temperature

Table 17: *Operating statuses*

10.4 Displaying operating values and changing settings

10.4.1 Call up main menu and navigate

In order to deactivate the screensaver and call up the main menu:

- press any key.
  The background lighting of the display lights up.
- Press the key once again.
  The screensaver disappears and the main menu appears.

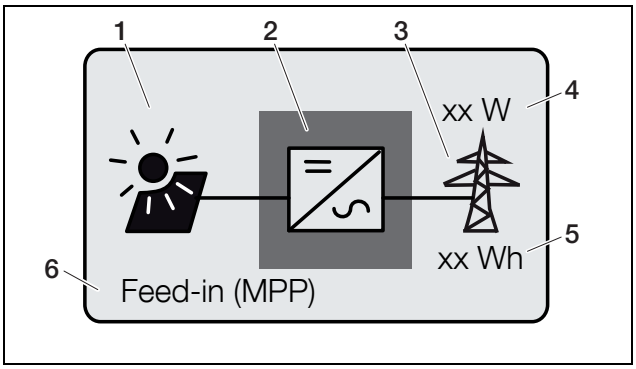


Fig. 63: *Main menu, menu settings selected*

1 "DC" menu
2 "Settings" menu
3 "AC" menu
4 Current AC power
5 Fed-in daily yield
6 Operational status

— In the "DC" menu you can call up information about the DC input side (see "DC menu" on page 42).
— In the "AC" menu you can view current performance data of the AC output side (see "AC menu" on page 42).
— In the "Settings" menu you can configure the inverter (see "Settings menu" on page 43).

In order to call up a menu:

▲ ▼	Press the arrow keys "UP" or "DOWN" repeatedly if necessary until the symbol for the desired menu is marked.
✓	Press the Enter key. The menu is opened.
<< oder zurück	After selecting and entering this menu item, you will be taken back to the next higher menu level.

Table 18: *Call up menu*

10.4.2 Navigation and entry within a menu

Navigation and entry	
ABC	Object with a dashed line means: Object is selected and can be activated with "Enter".
ABC	Object with black background: Object is active and can be edited.
▲ ▼	Select with the arrow keys: letters and numbers
A	Letter or number with black background means: Letter or number is selected and can be changed with the arrow keys.
<<<	Use this function to delete letters and numbers (corresponds to the backspace key).
✓ ca. 3s	Pressing "Enter" for an extended time confirms the entry.

Table 19: *Navigation and entry in the settings menu*

10.4.3 DC menu

- In the "DC" menu you can call up information about the DC input side. Information about the voltage (U), the amperage for direct current (I) and the power (P) is available:

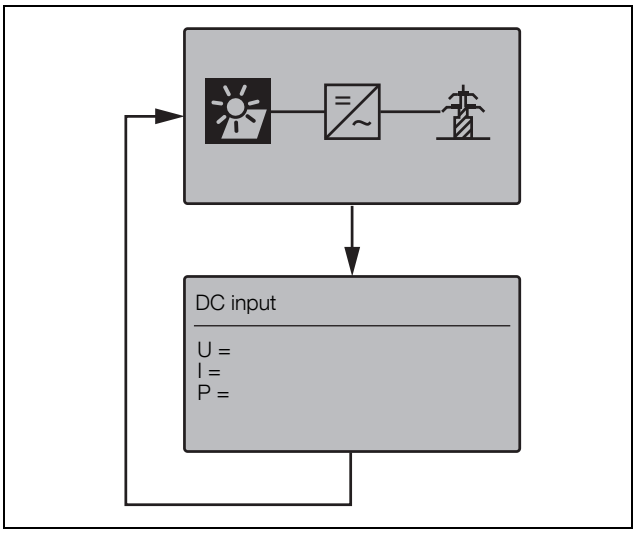


Fig. 64: *"DC" menu*

10.4.4 AC menu

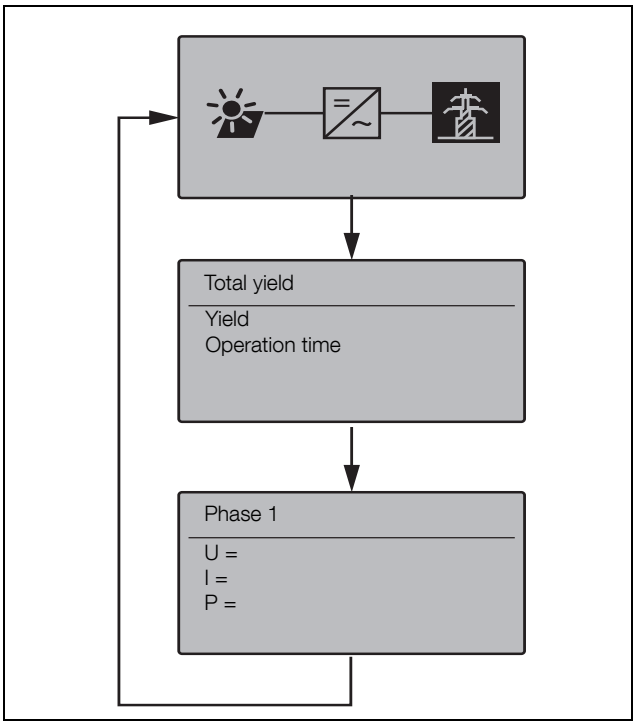


Fig. 65: *"AC" menu*

10.4.5 Settings menu

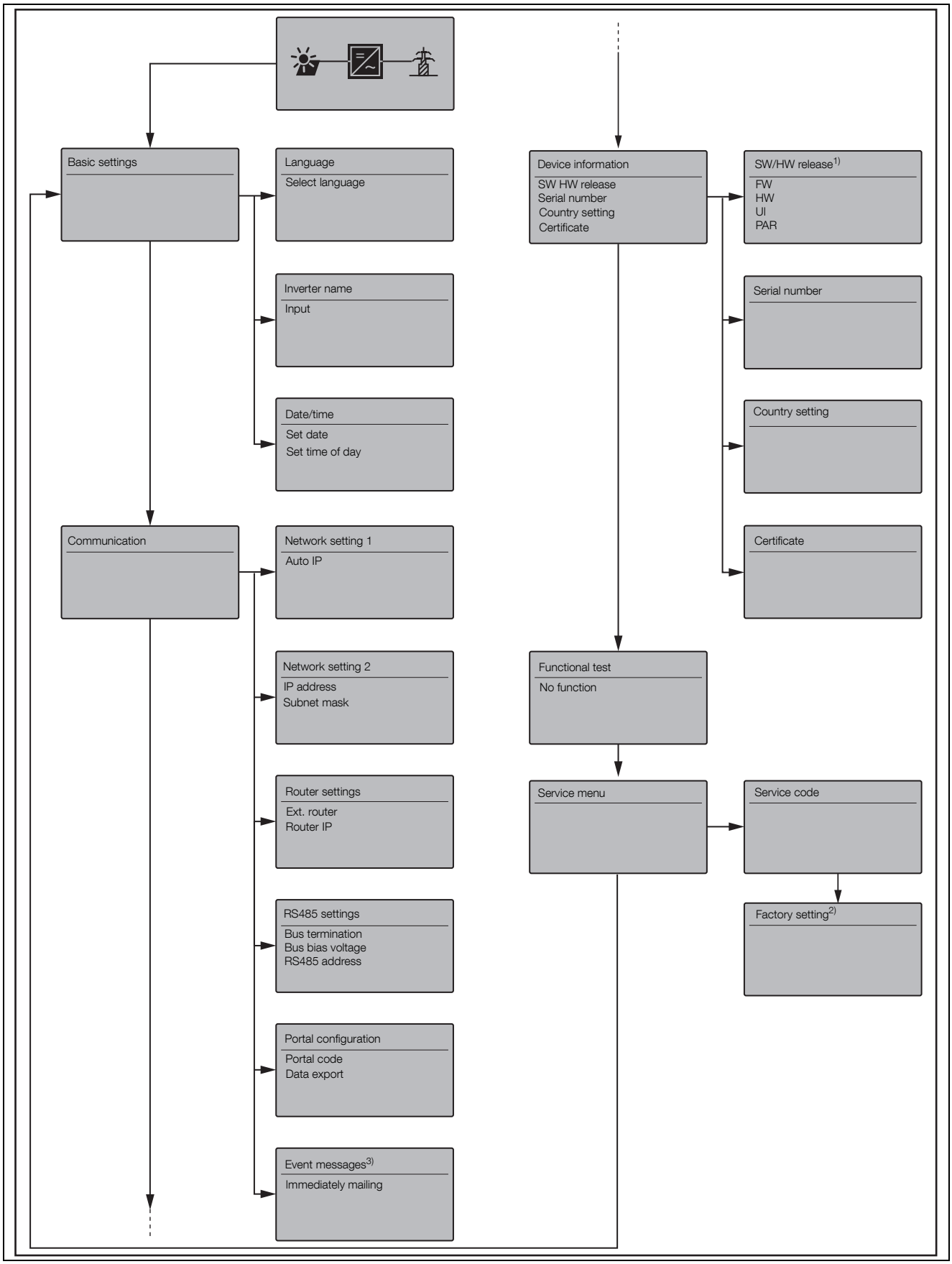


Fig. 66: *Settings menu*

1 **SW/HW version**
Pure display (like type plate)
FW: Firmware version
HW: Hardware version
UI: Software version of the communication board
PAR: Version of the parameter file

2 **Factory settings**
In this menu the inverter can be reset to the factory setting.
Attention: All user settings are lost during this reset. However, the country setting remains unchanged.

3 **Event messages**
Event messages can be faults or other events. The "immediately mailing" option sends the event message immediately following the data capture period to an Internet portal.
Note: When a data flat rate is not present, the data transfer with a GSM modem can result in higher costs.

Note: The menu structure shown here can differ from the menu structure shown on your device depending upon the version.

10.5 Faults

The inverter interrupts the feed-in and switches off in the event of a fault.

- Check whether the DC switch or the external DC isolator has been opened.
- Check if the fault is due to a mains power failure or if the fuse between the feed meter and the inverter has tripped.

⚠ DANGER

Risk of death due to electrical shock!

Deadly voltages are present in the inverter. Only a qualified electrician may open and perform work on the device.

If the fuse has tripped, notify the installer; if there is a power failure, simply wait until the grid operator has corrected the problem.

If the fault lasts only a short time (mains fault, overheating, overload, etc.), then the inverter will automatically resume operation as soon as the fault has been resolved.

If the fault persists, **notify your installer or the manufacturer's customer service department** (for contact information, see back page).

Provide the following information:

— Device type and serial number. You will find this information on the type plate on the exterior of the housing.

— Description of fault (LED indicator and display message).

Event list

There is no need to take action when a fault occurs occasionally or only briefly and the device resumes operation. When a fault occurs over long periods or recurs often, the cause must be determined and corrected. The following table should be helpful in the process.

Message on the screen Event code: xxx	Type of fault	Description	Measures
Fan fault			
1	**Warning** **Fan blockage le**	Blockage of left fan	Clean fans where necessary Check plugs, connection cables and fans for damage Contact the hotline when the cause cannot be determined Attention: Fan test only possible in feed-in operation mode!
2	**Warning** **Fan blockage ri**	Blockage of right fan	
3	**Warning** **Fan speed le**	Left fan too slow	
4	**Warning** **Fan speed ri**	Right fan too slow	
Mains fault [red LED lights]			
106	**Fault,** **Neutral conductor**	Neutral conductor not connected correctly	Check neutral conductor
150	**Fault,** **Grid fault**	Grid frequency error	Check grid frequency where possible
151 - 164	**Fault,** **Mains voltage**	Grid error during feed-in	Check grid (especially when switching) ALL phases and N against PE
165 - 178	**Fault,** **Frequency**	Frequency error	Check frequency of the grid (operation with emergency power unit not possible)
240	**Fault,** **Grid fault**	Overcurrent on AC side	Contact technical support in the event of enduring or constant occurrence
241			
250		Mains voltage too high or too low	Check mains voltage
251 - 278	**Fault,** **Mains voltage**	Mains voltage error	
279 - 292	**Fault,** **Phase error**	Phase error	Check phase angle where possible

Table 20: *Events*

Message on the screen Event code: xxx	Type of fault	Description	Measures
Residual current [red LED blinks]			
300 - 399	**Fault** **Residual current**	Switch-off due to residual current	Check the electrical installation for insulation errors, the DC side (PV modules) as well as the AC side (grid). Causes for faults might include: worn cable insulation, falsely connected plug-in connectors, moisture. Check insulation resistance (1kOhm / V, min 500 kOhm)
Insulation error [red and yellow LEDs light up]			
400 - 401	**Fault** **Insulation error**	The insulation resistance is too low	Check system at the module side for damaged insulation, false plug connections, dampness and damage in the module insulation Check insulation resistance (1kOhm / V, min 500 kOhm)
Arc fault [red LED lights, yellow LED blinks and a signal tone is heard]			
501	**Fault** **Arc**	Parallel arc on string 1	After each arc error, be absolutely sure to inspect the entire installation of the PV system for damage that could indicate an arc. Inform your installer where appropriate.
502	**Fault** **Arc**	Parallel arc on string 2	
503	**Fault** **Arc**	Parallel arc on string 3	
504	**Fault** **Arc**	Serial arc on string 1	
505	**Fault** **Arc**	Serial arc on string 2	
506	**Fault** **Arc**	Serial arc on string 3	
Overheating [green LED flashes]			
601 - 615	**Fault** **Overheating**	Device has become too hot. The inverter has derated or temporarily switched off the power.	Wait until the device has cooled down. The installation site is possibly not perfect and the inverter is not receiving enough cooling air. The inverter should not be exposed to direct sunlight where possible. Check fans for dirt and clean, if necessary.
System fault [red and yellow LEDs flash]			
800 - 999	**Fault** **System fault**	Internal system fault	Sporadic, brief occurrence: No measures necessary Frequent, brief occurrence: Contact technical support Permanent occurrence: De-energise the inverter completely. Recommence operation after 5 minutes In the event of continuing problems, contact technical support

Table 20: *Events*

11 System monitoring

Also observe the descriptions about communication and accessories in chapter 9.2 from page 32 on.

The inverter regularly records performance data (voltage, power, energy) of the DC and the AC side.

Note: Some of the data will also be shown on the inverter display during operation (see chapter 10.4).

There are two ways of retrieving, displaying and permanently saving all log data:

— Transfer the log data to a solar portal.

— Download the log data with a computer.

You can, of course, make use of both options together.

Transfer the log data to a solar portal.

The inverter can transfer its log data automatically and at regular intervals to a solar portal in the Internet. The data transfer may incur additional costs. As a rule, you must register the inverter with the solar portal operator. You can find further information at our service hotline. See also chapter 9.2.1.

The solar portal displays the data on an Internet page and archives them. This enables you to view the status of your photovoltaic system at any time and from anywhere. All you need is access to the Internet (computer, Internet hotspot, mobile phone, etc.).

Downloading the log data onto a computer.

Retrieve the performance data of your photovoltaic system directly from the inverter. To do so, establish a connection to your inverter with a computer. The integrated web server displays the current performance data clearly on HTML pages so that you can access the data with any conventional Internet browser. No special software is needed. You can also download all saved log data and display it using the free visualisation software PIKO MasterControl (see chapter 11.3). Alternatively, you can use a spreadsheet application.

11.1 Logging into the web server

- Switch on your computer.
- Only for dialling in via GSM modem: Establish a dialling connection to the modem in the inverter.
- Open your Internet browser program.

Note: Ensure that the proxy server for LAN connections has been deactivated.
You can find further instructions concerning network settings in the operating system manual for your computer.

- If your computer is connected to the inverter **via a network cable**, enter an "S" into the address line of the browser, followed by the serial number of the inverter (see type plate), for example **http://S12345FD323456**

  ➜ The log-in window for the web server opens.

- If your computer is connected to the modem in the inverter **via dial-up connection**, enter the letters "wr.S" in the browser's address line followed by the serial number of the inverter (see type plate), for example **http://wr.S.12345FD323456**

  ➜ The log-in window for the web server opens.

Note: Instead of the serial number, you can also use the name of the inverter or the IP address, for example **http://name** or for a dial-in connection **http://wr.name** or **http://192.168.1.51** (if the inverter has this IP address).

You can find out how to allocate a name to the inverter or to change the name in section ‹Changing the name› in chapter 9.2.

- Enter user name and password. The factory defaults for user name and password are set as follows:

  User name: pvserver
  Password: pvwr

  You can change the password in the settings of the web server at any time (see section ‹Changing the password› in chapter 9.2). The user name cannot be changed.

- Click on "OK" to confirm your entry.

  ➜ The main screen of the web server will be displayed.

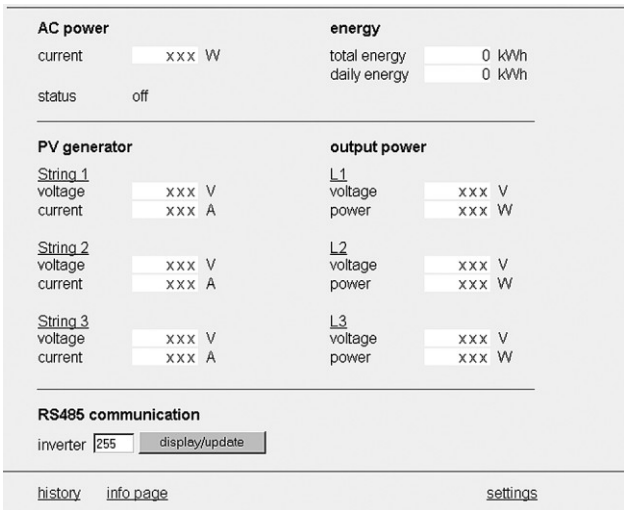


Fig. 67: Main page of the web server

By clicking on the button "Display/update", you can update the data or, when operating several inverters that are linked via an RS485 network, select a different inverter via its RS485 address and retrieve its current performance data.

11.2 Downloading log data

With the log data it is possible to display the yield data of the PV system. Errors can also be determined with the log data.

The log data of the inverter can be downloaded as a DAT or a txt file. (The log data are explained in table 21 on page 48.)

Procedure:

- On the main page of the web server, click on the "History" link.
  - ➜ A window with the options "Open" or "Save" opens.
- — Option "Open": the data can be opened and processed with a table calculation program.
- — Option "Save": the data are saved on your hard drive. After saving, these data can be displayed and further processed.

Note: Regularly create backup copies of your saved log data.

11.3 Display log data

The log data include information on your photovoltaic system.

In order to comfortably display the log data, we recommend using the **visualisation software** PIKO MasterControl V2 (LC V2). With this software you can directly access the inverter, download and display the data. You can download this free of charge from the download area of our website www.kostal-solar-electric.com

Note: The software PIKO Master Control V2 (PMC V2) cannot import DAT or txt files.

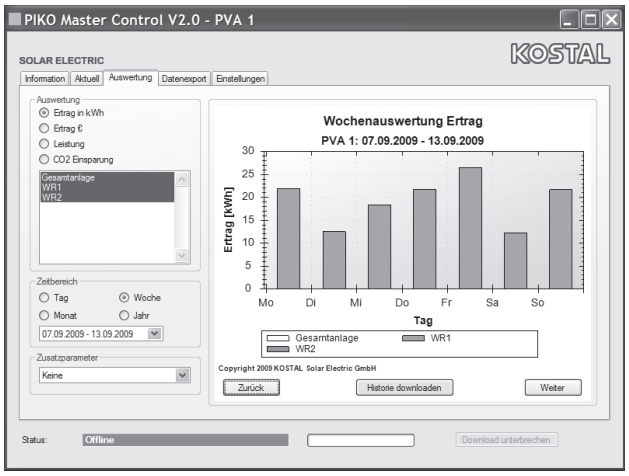


Fig. 68: Visualisation software PIKO MasterControl V2

If you are not using visualisation software, you can display the log data with any conventional spreadsheet application.

Entry	Explanation
Time	Details in seconds of the time since the inverter went into operation
DC1 U DC2 U DC3 U	DC voltage: Input voltage of the respective string (1, 2 and 3) in V
DC1 I DC2 I DC3 I	DC current: Input current of the respective string (1, 2 and 3) in mA
DC1 P DC2 P DC3 P	DC power: Input power of the respective string (1, 2 and 3) in W
DC1 T DC2 T DC3 T	DC temperature: Details for service
DC1 S DC2 S DC3 S	DC status: Details for service
AC1 U AC2 U AC3 U	AC voltage: Output voltage of the respective phase* (1, 2 and 3) in V
AC1 I AC2 I AC3 I	AC current: Output current of the respective phase* (1, 2 and 3) in mA

Table 21: Log data

Entry	Explanation
AC1 P AC2 P AC3 P	AC power: Output power of the respective phase* (1, 2 and 3) in W
AC1 T AC2 T AC3 T	AC temperature: Details for service
AC F	AC frequency: Grid frequency in Hz
AC S	AC status: Value Meaning 0 Inverter off 1 Inverter in standby 2 Inverter starting up 28 Feed-in*
FC I	Residual current: Measured residual current in mA
AIn1 AIn2 AIn3 AIn4	Analogue input voltage: display of the analogue inputs 1 to 4 of the communication board. The measured voltage value in V can be calculated with the value from the table (digits) and the following formula: input voltage [V] = (10/1024) * digits If the S0 input is used to count the energy pulses, both table columns AIn3 and AIn4 give the sum of the energy pulses per log interval. This total value is calculated as follows: E_{total} = AIn3 * 2^{16} + AIn4
ERR	General malfunctions
ENS S	Status of the ENS (device for grid monitoring with assigned switching elements): Status of grid monitoring Value Meaning 0 Grid monitoring deactivated 1 Initialisation phase 2 Pending (start-up of inverter) 3 Running (current feed-in to the grid) 15 Error
ENS Err	Malfunction of the ENS (device for grid monitoring with assigned switching elements)
KB S	Internal status of the communication: internal communication status when switching to AC grid.
Total E	Total energy: total fed-in energy in kWh when switching to AC grid.
Iso R	Insulation resistance: insulation resistance in kOhm when switching to AC grid.
Event	POR event, "power on reset": renewed start-up of communication after a loss of AC voltage.

Table 21: *Log data (cont.)*

* With limited input power use PIKO 4.2/5.5/7.0/8.3/10.1 only one or two phases for current feed-in. The device selects the phase on a random basis each time.

Abbreviations

— AC: alternating current, designation for alternating current
— DC: direct current, designation for direct current
— U: voltage in volts [V]
— I: current strength in milliamps [mA]
— P: power in watts [W]
— E: energy in kilowatt hours [kWh]
— F: frequency in Hertz [Hz]
— R: resistance in kiloohms [kohm]
— T: counting unit in points [digits]
— AIn: counting unit in points [digits]
— Time: details in seconds [sec] since the inverter was put into operation

11.4 End data transfer to a solar portal

You can end an activated data transfer to a solar portal at any time.

- Open the setting page of the web server.
- Click the box next to the name of the portal to deactivate the data export to the solar portal (☐).
- Click on "Accept" to apply and save the settings.

Note: To activate the data transfer, see chapter 9.2.3 (page 37).

12 Appendix

12.1 Technical data

	PIKO				
	4.2 (DCS)	**5.5 (DCS)**	**7.0 (DCS, AD)[3]**	**8.3 (DCS, AD)[3]**	**10.1 (DCS, AD)[3]**
Input side (DC)					
Number of DC inputs/ Number of MPP trackers	2 / 2	3 / 3	2 / 2	2 / 2	3 / 3
Recommended DC power	5 to 10% above AC rated output[1]				
Max. DC input voltage (idling voltage)	950 V				
Min. DC input voltage	180 V				
DC start input voltage	180 V				
DC nominal voltage	680 V				
Max. MPP voltage	850 V				
Min. MPP voltage in single-tracker operation	500 V	660 V	Not recommended		
Min. MPP voltage in dual-tracker or parallel operation	360 V	360 V	400 V	400 V	420 V
Max. DC input current	9 A / 13 A[2]	9 A	12.5 A / 25 A[2]		
Max. DC input current with parallel connection	13 A	–	25 A		
Output side (AC)					
Number of feed-in phases	3				
AC mains voltage	3/N/PE, AC, 230/400 V				
Max. AC output current	6.1 A	8 A	10.2 A	12 A	14.5 A
AC rated output (cos φ = 1)	4,200 W (UK: 4000 W, PT1: 3680 W PT2: 3,450 W)	5,500 W (IC: 5000 W, PT: 5000 W)	7,000 W	8,300 W	10,000 W
AC apparent power (cos φ, adj)	4,200 VA	5,500 VA	7,000 VA	8,300 VA	10,000 VA
Power factor cos φ_{ACr}	0.9 capacitive ... 1 ... 0.9 inductive				
Max. degree of efficiency η_{max}	96.5%	96.2%	97.0%	97.0%	97.0%
European efficiency η_{EU}	95.4%	95.7%	96.3%	96.3%	96.4%
Rated frequency	50 Hz				

Table 22: *Technical data*

1 dependent upon ambient temperature and solar irradiation

2 with parallel connection of two MPP trackers

3 This inverter is available in two variants: with or without arc detection

	PIKO				
	4.2 (DCS)	**5.5 (DCS)**	**7.0 (DCS, AD)[3]**	**8.3 (DCS, AD)[3]**	**10.1 (DCS, AD)[3]**
Power requirements for night operation	Inverter < 1 W, communication board < 1.7 W				
Protection class	I				
Transformerless topology	Transformer-less				
Type of grid monitoring	according to national certificate				
Reverse polarity protection	Short circuit diodes on DC side				
Operator protection	AFI and ground monitoring				
Conditions of usage, protection type according to IEC 60529	inside + outside, IP 55				
Ambient temperature	–20…+60 °C				
Air humidity	0…95%				
Cooling principle	regulated fans				
Communication interfaces	Ethernet (RJ45) (2x for communication board 2, incl. integrated switch), RS485, S0, 4x analogue inputs				
Max. noise	< 33 dB(A)		Fan 25% - 33 dB(A) Fan 50% - 41 dB(A) Fan 75...100% - 46 dB(A)		
Connection technology at input side	MC 4				
Connection technology at output side	Spring-loaded terminal strip				
Dimensions (W × D × H)	420 × 211 × 350 mm		520 × 230 × 450 mm		
Weight (approx.)	20.5 kg	21.1 kg	33 kg	33 kg	34 kg
Disconnection device	electronic isolation switch, integrated				

Table 22: *Technical data (cont.)*

12.2 Block diagram

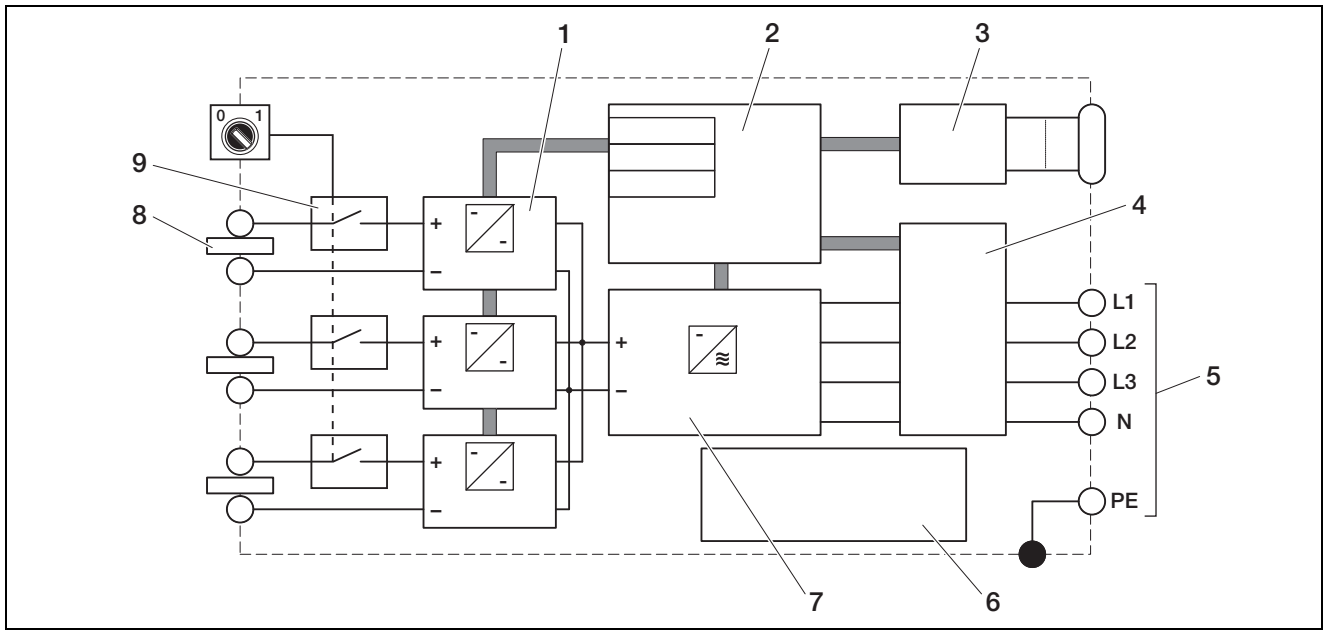


Fig. 69: *Block diagram (illustration shows PIKO 10.1)*

1 DC regulator (1 to 3, depending on model)
2 System control with MPP regulators
3 Display and communication
4 Grid monitoring and shut-down
5 3-phase AC output
6 Power supply unit
7 Inverter bridge
8 PV string (1 to 3, depending on model)
9 Electronic DC load break switch

12.3 Type plate

The type plate is located on the right side of the inverter. You will find the device type and the most important technical data listed on the type plate.

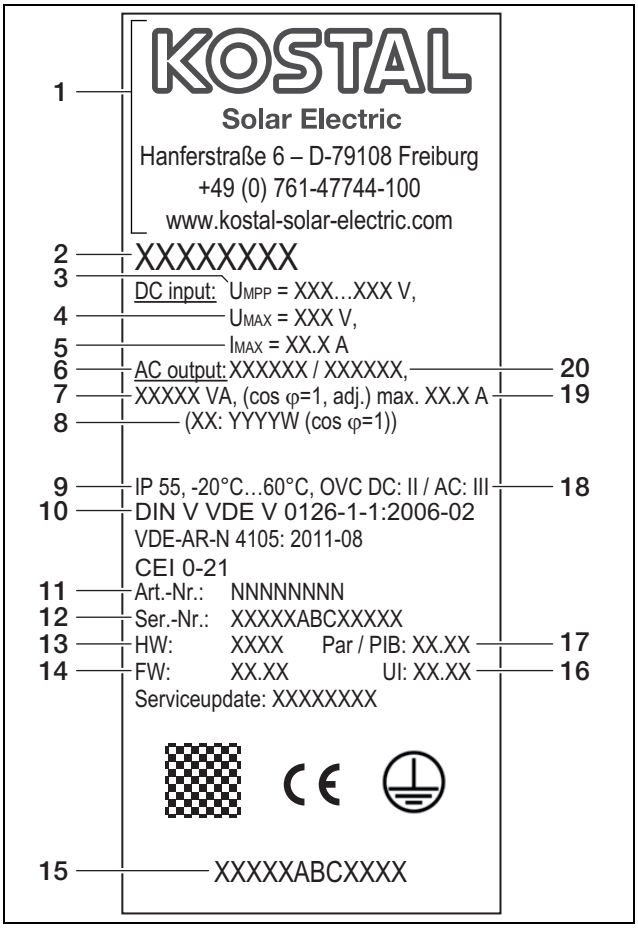


Fig. 70: *Type plate (example)*

1 *Name and address of manufacturer*
2 *Device type*
3 *MPP control range*
4 *Maximum input voltage DC*
5 *Maximum DC input current*
6 *Number of feed-in phases*
7 *Maximum AC power*
8 *Deviating power output with country setting*
9 *Protection type and ambient temperature range*
10 *Requirements conforming to those of the built-in grid monitoring*
11 *Item number*
12 *Serial number*
13 *Version number of the hardware*
14 *Version number of the firmware*
15 *Removable guarantee label with device type and serial number*
16 *Version number of the user interface of the device*
17 *Version number of set of parameters*
18 *Overvoltage category*
19 *Maximum output current AC*
20 *Output voltage (nominal)*

12.4 Warranty and service information

Information on the warranty can be found in the warranty conditions, which are included separately.

Do you have any technical questions regarding your inverter? Our hotline +49 (0)761 477 44 - 222 is happy to provide assistance.

For service information and a possible shipment of parts, we require your device type and the serial number. You will find this information on the type plate on the exterior of the housing.

If parts are required, use only genuine replacement parts.

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